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REGIONAL ANATOMY

VOLUME III



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REGIONAL ANATOMY

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VOLUME III

THE HEAD AND NECK

NEW AND REVISED EDITION

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THE HEAD AND NECK

A STUDY of the head and neck comprises an examination of the following regions:—

1. The scalp and superficial dissection of the temporal region.
2. The dorsal aspect of the trunk and the apical portion of the posterior triangle of the neck.
3. The suboccipital triangle.
4. The dissection of the neck.
 - A. The posterior triangle.
 - B. The anterior triangle.
 - C. The middle line of the neck.
5. The face.
6. The deep temporal and pterygo-maxillary regions.
7. The submaxillary region.
8. The deep dissection of the neck.
9. The interior of the cranium.
10. The orbit.
11. The mouth, tongue, pharynx, and soft palate.
12. The sphenomaxillary fossa and the adjacent structures.
13. The nasal fossæ.
14. The prevertebral region.

I. THE SCALP AND SUPERFICIAL DISSECTION OF THE TEMPORAL REGION

Definition.—The *scalp* may be defined as including the soft parts which cover the vault of the skull above the level of the temporal ridges *laterally*, and between the supra-orbital margins *in front*, and the superior curved lines of the occipital bone *behind*. With the scalp are included the superficial structures of the temporal region.

The *temporal region* may be defined as including that portion of the skull which lies between the superior temporal ridges and the zygoma.

Five cranial bones take part in its formation, namely, the frontal, great wing of the sphenoid, parietal, temporal, and malar bones. This region gives origin to the temporal muscle.

Layers of the Scalp.—There are five layers in the scalp, as follows:—

The skin.

The superficial fascia.

The epicranial aponeurosis.

The loose areolar tissue—the “dangerous area” of the surgeon.

The pericranium.

The Skin.—The skin, forming the hairy scalp, is firmly connected to the epicranial aponeurosis by the fibres of the superficial fascia; hence, whenever the muscular portion of the epicranial aponeurosis contracts, the hairy scalp is moved with it.

The Superficial Fascia.—The superficial fascia of the scalp is peculiar in consisting of short strands of fibrous tissue which pass at right angles to the skin and firmly connect it to the underlying epicranial aponeurosis. Between these strands of fibrous tissue there are numerous small spaces containing lobules of fat.

The Epicranial Aponeurosis.—This extensive aponeurosis is a most important structure in the surgery of the scalp. It is composed of the two occipito-frontales muscles and their intermediate tendons; as these tendons are flattened out they are termed aponeuroses, as are all tendons which are so flattened out.

The *occipito-frontales muscles* are two in number, one on each side. Each muscle is, in reality, a digastric muscle, as it consists of two muscular bellies and an intermediate tendon.

The Anterior Muscular Belly or the Frontalis Muscle.—This part of the epicranial aponeurosis passes from the subcutaneous tissue at the root of the nose and along the eyebrow, upwards to the tendinous portion of the aponeurosis, which it reaches about midway between the coronal suture and the frontal eminence.

The Posterior Muscular Belly, or the Occipitalis Muscle.—This part of the epicranial aponeurosis extends from the mastoid process and outer two-thirds of the superior curved line of the occiput, upwards to the tendinous portion of the aponeurosis, which it reaches after a course of about one inch and a half.

The Tendinous Portion of the Epicranial Aponeurosis.—This constitutes the intermediate tendon which unites the two muscular bellies together.

In front, it extends downwards to the root of the nose between the two frontales muscles; these two muscles are, therefore, separated by a V-shaped portion of the intermediate tendon.

Behind, it extends downwards between the two occipitales muscles to the external occipital protuberance, and the inner third of each superior curved line of the occiput.

From its *lateral* margins a thin prolongation is continued downwards to the zygoma.

Attachments of the Epicranial Aponeurosis.—The epicranial aponeurosis in its entirety forms a species of skull cap, which covers the entire vault of the skull. If the foregoing attachments have been carefully studied, it is obvious that the attachments of the epicranial aponeurosis are:—

In front, to the root of the nose and the orbital margin.

Laterally, to the zygoma, the pinna, and the mastoid process.

Behind, to the superior curved line of the occiput and the external occipital protuberance.

These attachments require careful study, as they explain the course taken by effusions occurring under cover of the epicranial aponeurosis, that is, in the “dangerous area.”

Nerve Supply.—The *frontalis* muscle is supplied by the temporal branches of the facial nerve; the *occipitalis* muscle by the posterior auricular branch of the same nerve.

Action.—The occipito-frontalis muscle moves the hairy scalp backwards and forwards, and also elevates the eyebrows, and wrinkles the skin of the forehead.

The Loose Areolar Tissue, or the “Dangerous Area.”—This layer consists of some loose connective tissue which lies between the epicranial aponeurosis and the pericranium.

The mobility of the scalp depends entirely upon the laxity of this layer.

This layer is termed the "*dangerous area*," on account of the ease with which a septic meningitis may follow the occurrence of suppuration in this layer. Suppuration, occurring in the "*dangerous area*," may produce a septic inflammation of the emissary veins which pass from this layer through the various small foramina in the vault of the skull to the meninges of the brain. Hence all scalp wounds which have opened into this layer require to be carefully treated.

The Pericranium.—The pericranium forms the external periosteum for the cranial bones, the dura mater forming the more important internal periosteum.

The pericranium is but slightly adherent to the bones, except at the sutures, where it is intimately united with the *sutural membrane*. Any effusion, occurring between the pericranium and the bone, will be limited to the particular cranial bone over which it occurs. One of the best examples of effusion in this region is the vascular effusion occasionally seen on the head of an infant at birth, and termed a *cephalhæmatoma*.

Layers of the Temporal Region.—The layers of the temporal region are eight in number, as follows:—

The skin.

The superficial fascia.

The extrinsic muscles of the ear.

The thin lateral prolongation of the epicranial aponeurosis.

A thin layer of fascia descending from the temporal ridge to the pinna.

The temporal fascia.

The temporal muscle.

The pericranium.

The Skin and Superficial Fascia.—The skin and superficial fascia of the temporal region differ in no way from those of the scalp.

The Extrinsic Muscles of the Ear.—These small unimportant muscles are three in number—the *retrahens aurem*, the *attrahens aurem*, and the *attollens aurem*.

The Retrahens Aurem.—This muscle *arises* from the

mastoid process of the temporal bone, and is *inserted* into the back of the concha. It is supplied by the posterior auricular branch of the facial nerve.

The Attrahens Aurem.—This muscle *arises* from the thin lateral prolongation of the epicranial aponeurosis, and, passing downwards and backwards, is *inserted* into the anterior part of the helix. It is supplied by the temporal branches of the facial nerve.

The Attollens Aurem.—This muscle also *arises* from the epicranial aponeurosis, and is *inserted* into the cranial aspect of the upper part of the ear. It is supplied by the posterior auricular branch of the facial nerve.

The Thin Lateral Prolongation of the Epicranial Aponeurosis.—This prolongation has already been described as passing down to the zygoma.

The Thin Layer of Fascia which descends from the Temporal Ridge to the Pinna.—This sheet of fascia is probably the equivalent in this region of the loose areolar tissue of the scalp, though its structure in no way resembles that layer of the scalp.

The remaining layers of the temporal region are described with the pterygo-maxillary region.

The Sensory Nerves of the Scalp and Temporal Region.—If the scalp and temporal region be divided into two parts, anterior and posterior, by a line drawn vertically upwards between the two ears, then the anterior half is seen to derive its sensory nerves from the *fifth cranial nerve*, and the posterior half from the *cervical spinal* nerves, both anterior and posterior primary divisions.

The Anterior Half of the Scalp.—The anterior half of the scalp derives its sensory supply entirely from the fifth cranial nerve.

This important nerve is the great sensory nerve of the head. It breaks up into three main divisions, a first or ophthalmic division, a second or superior maxillary division, and a third or inferior maxillary division.

The *ophthalmic* division leaves the cranial cavity through the sphenoidal fissure, the *superior maxillary* division through the foramen rotundum, and the *inferior maxillary* division

through the foramen ovale. Each one of these three divisions of the fifth cranial nerve sends sensory branches to the anterior half of the scalp, as follows:—

From the ophthalmic division—

The supra-orbital nerve.

The supra-trochlear nerve.

From the superior maxillary division—

The temporal branch of the orbital nerve.

From the inferior maxillary division—

The auriculo-temporal nerve.

The Supra-Orbital Nerve.—This nerve leaves the orbit through the supra-orbital notch. It divides, either in the orbit or immediately after reaching the scalp, into two branches, inner and outer. These two branches ascend between the frontalis and orbicularis palpebrarum muscles and the bone, and supply the skin of the scalp on its upper and anterior parts.

The *inner* branch soon pierces the frontalis muscle, and extends as far as the parietal bone.

The *outer* and larger of the two branches pierces the epicranial aponeurosis higher up and extends nearly as far as the lambdoid suture.

The Supra-Trochlear Nerve.—This nerve, much smaller than the supra-orbital, leaves the orbit just above the trochlea of the superior oblique muscle, that is, at the inner canthus, and ascends to the scalp between the orbicularis palpebrarum muscle and the bone, and supplies the skin over the lower and internal parts of the forehead.

The Temporal Branch of the Orbital Nerve.—This is a very small nerve, which becomes cutaneous by piercing the temporal fascia a finger's-breadth above the zygoma, and just behind the small tubercle on the malar bone. It supplies the skin over the anterior part of the temporal region.

The Auriculo-Temporal Nerve.—This nerve passes upwards superficially to the zygoma, and immediately in front of the ear, accompanying the superficial temporal artery. After reaching the scalp it divides into two branches, anterior and posterior; the *anterior* branch passes upwards to supply the skin over the temporal region, the *posterior* branch passes backwards to supply the skin just above the ear.

The Posterior Half of the Scalp.—The posterior half of the scalp derives its sensory supply entirely from the anterior and posterior primary divisions of certain of the cervical spinal nerves, as follows:—

From the anterior primary divisions—

The small occipital nerve.

From a posterior primary division—

The great occipital nerve.

The Small Occipital Nerve.—This nerve is one of the ascending branches of the superficial division of the cervical plexus; it is derived from the anterior primary divisions of the second and third cervical nerves, and after running upwards along the posterior border of the sterno-mastoid muscle, it reaches the scalp midway between the external occipital protuberance and the ear. It supplies the skin behind and above the ear.

The Great Occipital Nerve.—The great occipital nerve is the internal branch of the posterior primary division of the second cervical nerve. It pierces the trapezius muscle one inch below the external occipital protuberance, and half an inch to the outer side of that point, and ascends to the scalp lying to the inner side of the occipital artery. It supplies the skin over the back part of the scalp.

The Motor Nerves of the Scalp.—All the motor nerves are derived from the great motor nerve of the head, the *seventh cranial or facial nerve*.

The *anterior* half of the scalp derives its motor supply from the temporal branches of the temporo-facial division of the facial nerve, and the *posterior* half of the scalp from the posterior auricular branch from the trunk of the same nerve.

The Temporal Branches of the Facial Nerve.—These nerves constitute the motor nerves for the *anterior* half of the scalp. They ascend over the zygoma, and supply the muscles in the anterior half of the scalp, namely, the frontalis, *attrahens aurem*, *orbicularis palpebrarum*, and *corrugator supercilii* muscles.

The Posterior Auricular Nerve.—This nerve constitutes the motor nerve for the *posterior* half of the scalp. It is derived from the trunk of the facial nerve, and passes upwards

accompanied by the artery of the same name, in front of the mastoid process and behind the ear, on to the scalp.

On the scalp the posterior auricular nerve divides into *occipital* and *auricular* branches, which supply the occipitalis, *retrahens aurem*, and *attollens aurem* muscles.

The Arteries of the Scalp.—The arteries of the scalp are derived from two main sources, as follows :—

From the internal carotid artery—

The supra-orbital artery.

The frontal artery.

From the external carotid artery—

The superficial temporal artery.

The posterior auricular artery.

The occipital artery.

The Supra-Orbital Artery.—This vessel, a branch of the ophthalmic artery from the internal carotid, leaves the orbit with the supra-orbital nerve, and is distributed to the skin and muscles over the anterior part of the forehead.

The Frontal Artery.—This vessel, which has the same origin as the supra-orbital artery, accompanies the supra-trochlear nerve, and has a somewhat similar distribution to the skin of the forehead. It is a much smaller artery than the supra-orbital.

The Superficial Temporal Artery.—This vessel ascends to the scalp in front of the ear and superficially to the zygoma; after reaching the scalp the artery divides into an anterior and a posterior superficial temporal artery.

(a) *The anterior superficial temporal artery* is a tortuous vessel, which passes forwards towards the forehead, and anastomoses with the supra-orbital and frontal arteries.

(b) *The posterior superficial temporal artery* is usually larger than the anterior; it passes upwards towards the vertex of the head, where it anastomoses with the corresponding branch of the opposite side. It also anastomoses behind, with the posterior auricular and occipital arteries.

The Posterior Auricular Artery.—This vessel reaches the scalp, in company with the posterior auricular branch of the facial nerve, between the ear and the mastoid process. It terminates by dividing into *auricular* and *mastoid* branches,

which supply the parts about the ear, and anastomose with the superficial temporal and occipital arteries.

The Third Part of the Occipital Artery.—The third part of the occipital artery makes its appearance between the trapezius and sterno-mastoid muscles. It is accompanied by the great occipital nerve, which lies immediately to the inner side of the artery. The artery passes upwards with a tortuous course, to supply the integuments of the upper and posterior parts of the scalp.

The Veins of the Scalp.—The veins of the scalp correspond to a large extent to the arteries. They all communicate freely with one another, and with the blood sinuses in the interior of the cranium by means of the emissary veins.

The Supra-Orbital Vein.—The supra-orbital vein joins the larger *frontal* vein to form the *angular* vein. This junction, which takes place at the inner canthus of the eye, constitutes the commencement of the *facial* vein.

The Superficial Temporal Vein.—The superficial temporal vein accompanies the posterior superficial temporal artery. It unites just above the zygoma with a more deeply situated vein,—the *middle temporal* vein,—to form the *common temporal* vein, which last descends superficially to the zygoma and accompanies the superficial temporal artery.

The Posterior Auricular Vein.—The posterior auricular vein passes downwards behind the ear, and eventually unites with the posterior division of the temporo-maxillary venous trunk, to form the *external jugular* vein.

The Occipital Veins.—The occipital veins pass deeply, to terminate in the commencement of the *deep cervical vein*.

II. THE DORSAL ASPECT OF THE TRUNK AND THE APICAL PORTION OF THE POSTERIOR TRIANGLE OF THE NECK

Definition.—This region comprises an extensive, but, with few exceptions, a very unimportant dissection. It includes chiefly the muscles of the back and the associated structures, and the apical portion of the more important posterior triangle.

It is quite unnecessary for the student to burden his

memory with the intricate attachments of the deeper muscles in the back; whilst the posterior triangle, being an important region, is discussed in its entirety at a later stage; so that, although the dissection and its description is long and tedious, it contains little of practical moment.

Cutaneous Nerves.—The cutaneous nerves of the *back* are all derived from the posterior primary divisions of the spinal nerves.

In the *apical portion of the posterior triangle* there are, in addition, two branches from the anterior primary divisions of the cervical spinal nerves.

The cutaneous nerves of the region may be summarised as follows:—

The Back.			Apical Portion of Posterior Triangle.			
Posterior Primary Divisions.			Anterior Primary Divisions.			
Cervical.	{	1 C	Does not divide into inner and outer.	Small occipital nerve. Great auricular nerve.		
		2 C			Great occipital. Third occipital.	Muscle. } Muscle. }
		3 C				
		4 C	Skin.			
		5 C	Skin.		Muscle.	
		6 C	Muscle.		Muscle.	
		7 C	Muscle.		Muscle.	
		8 C	Muscle.		Muscle.	
Dorsal.	{	1 D	Skin.	Muscle.		
		2 D	Skin.	Muscle.		
		3 D	Skin.	Muscle.		
		4 D	Skin.	Muscle.		
		5 D	Skin.	Muscle.		
		6 D	Skin.	Muscle.		
		7 D	Muscle.	Skin.		
		8 D	Muscle.	Skin.		
Lumbar.	{	9 D	Muscle.	Skin.		
		10 D	Muscle.	Skin.		
		11 D	Muscle.	Skin.		
		12 D	Muscle.	Skin.		
		1 L	Muscle.	Skin.		
		2 L	Muscle.	Skin.		
		3 L	Muscle.	Skin.		
		4 L	Muscle.	Muscle.		
Sacral.	{	5 L	Muscle.	Muscle.		
		1 S	Muscle.	Skin.		
		2 S	Muscle.	Skin.		
		3 S	Muscle.	Skin.		
Coccygeal	{	4 S	Does not divide into	inner and outer.		
		5 S	Does not divide into	inner and outer.		
Coccygeal	1 C	Does not divide into	inner and outer.			

The Posterior Primary Divisions of the Spinal Nerves.—The skin of the back being a post-axial structure, that is, a structure lying behind the vertebral column, is supplied throughout by the posterior primary divisions of the spinal nerves.

With four exceptions, all the posterior primary divisions divide into an inner and an outer branch. Down to the level of the sixth dorsal vertebra the inner branch supplies the skin and the outer branch muscles. Below that level this is reversed.

Cervical Nerves.—The posterior primary division of *the first cervical or suboccipital nerve* does not divide into inner and outer branches, and is purely muscular.

The internal branch from the posterior primary division of *the second cervical nerve* is termed, from its size and ultimate distribution, the *great occipital nerve*. It pierces the trapezius muscle one inch below the external occipital protuberance, and half an inch to the outer side of that point, and ascends to the scalp lying to the inner side of the occipital artery. It supplies the skin over the back part of the scalp.

The internal branch from the posterior primary division of *the third cervical nerve* gives a cutaneous branch which occasionally reaches the scalp, and then lies to the inner side of the great occipital. It is termed the *occasional third occipital*. More usually, the nerve enters the superficial fascia close to the mesial plane, and then turns transversely outwards to supply the skin of the neck.

The internal branches from the posterior primary divisions of *the fourth and fifth cervical nerves* enter the superficial fascia close to the mesial plane, and then turn transversely outwards to supply the skin of the neck.

The internal branches from the posterior primary divisions of *the sixth, seventh, and eighth cervical nerves*, give no cutaneous branches, but terminate in the semispinalis colli muscle.

Dorsal Nerves.—The posterior primary divisions of *the upper six dorsal nerves* supply the skin by their *internal branches*, which emerge near the middle line of the body,

and then turn outwards to supply the skin. The cutaneous branch from the second nerve extends outwards beyond the spine of the scapula.

The posterior primary divisions of *the lower six dorsal nerves* supply the skin by their *external* branches, which emerge in a line with the angles of the ribs and the outer border of the erector spinæ muscle.

Lumbar Nerves.—The posterior primary divisions of *the first, second, and third lumbar nerves* supply the skin by their external branches. These nerves pierce the aponeurosis of the latissimus dorsi muscle, and, crossing the iliac crest near the outer border of the erector spinæ, supply the skin of the buttock.

The posterior primary divisions of *the fourth and fifth lumbar nerves* give no cutaneous branches at all, both the internal and external branches supplying muscles only.

Sacral Nerves.—The posterior primary divisions of *the first, second, and third sacral nerves* supply the skin by their external branches. After forming a series of loops, they become cutaneous by piercing the gluteus maximus along a line drawn from the posterior superior iliac spine to the tip of the coccyx.

The posterior primary divisions of *the fourth and fifth sacral and the coccygeal nerves* do not divide into inner and outer branches.

Of the thirty-one pairs of spinal nerves the posterior primary divisions of all divide into internal and external branches with the exception of the following four nerves:—

The first cervical nerve.

The fourth sacral nerve.

The fifth sacral nerve.

The coccygeal nerve.

Cutaneous Arteries.—The various cutaneous nerves of the back are accompanied by small cutaneous arteries, which are considered with the arteries of the back.

The Cutaneous Nerves of the Apical Portion of the Posterior Triangle.—These nerves are derived from the *anterior primary divisions* of the second and third cervical nerves. They are two in number, the small occipital nerve

and the great auricular. Both these nerves make their appearance at the middle of the posterior border of the sterno-mastoid muscle.

The small occipital nerve runs upwards to the scalp along the posterior border of the sterno-mastoid muscle.

The great auricular nerve ascends to the ear, crossing the sterno-mastoid superficially.

The Apical Portion of the Posterior Triangle of the Neck.—This triangle, of which the apex alone can now be seen, is fully described later.

Its boundaries, only some of which are now visible, are as follows:—

The Base.—The base is below, and is formed by the middle third of the clavicle.

The Apex.—The apex is formed at the superior curved line of the occipital bone, by the convergence of the sterno-mastoid and trapezius muscles. In non-muscular subjects these muscles may not meet, in which case the apex will be blunted.

The Anterior Boundary.—The anterior boundary is formed by the posterior border of the sterno-mastoid muscle.

The Posterior Boundary.—The posterior boundary is formed by the anterior border of the trapezius muscle.

The Floor.—The floor of the posterior triangle is a muscular floor. It is formed by the following muscles:—

The splenius capitis et colli muscle.

The levator anguli scapulæ muscle.

The scalenus medius muscle.

The scalenus posticus muscle.

The first digitation of the serratus magnus muscle.

The Roof.—The roof of the posterior triangle is formed by the deep cervical fascia.

Contents.—The contents of the posterior triangle *which are now visible* are as follows:—

The small occipital nerve, and the great auricular nerve as they appear at the middle of the posterior border of the sterno-mastoid muscle.

The spinal accessory nerve.

The cervical nerves to the trapezius muscle.

The cervical nerves to the levator anguli scapulæ muscle.

The occipital artery in non-muscular subjects where the apex of the triangle is blunted.

The Spinal Accessory Nerve.—The spinal accessory or eleventh cranial nerve appears in the posterior triangle at the middle of the posterior border of the sterno-mastoid muscle. It crosses the triangle obliquely, and, passing downwards and backwards, disappears under cover of the anterior border of the trapezius muscle. It supplies the two muscles which bound the posterior triangle, namely, the sterno-mastoid and the trapezius.

The Cervical Nerves to the Trapezius Muscle.—These nerves, two or three in number, are derived from the anterior primary divisions of the third and fourth cervical nerves. They run parallel with, and at a lower level than, the spinal accessory nerve, and supply the trapezius muscle.

The Cervical Nerves to the Levator Anguli Scapulæ Muscle.—These nerves are derived from the anterior primary divisions of the third and fourth cervical nerves. They supply the levator anguli scapulæ muscle.

The Muscles of the Back.—The muscles of the back may be arranged in six layers, as follows:—

First Layer.

The trapezius muscle.

The latissimus dorsi muscle.

Second Layer.

The levator anguli scapulæ muscle.

The rhomboideus major muscle.

The rhomboideus minor muscle.

Third Layer.

The serratus posticus superior muscle.

The serratus posticus inferior muscle.

Fourth Layer.

The splenius capitis et colli muscle.

The erector spinæ muscle.

Outer Column.

Ilio-costalis.

Musculus accessorius.

Cervicalis ascendens.

Middle Column.

Longissimus dorsi.

Transversalis cervicis.

Trachelo-mastoid.

Inner Column.

Spinalis dorsi.

Fifth Layer.

The complexus muscle.

The semispinalis colli et dorsi muscle.

The multifidus spinæ muscle.

Sixth Layer.

The rotatores dorsi muscles.

The interspinales muscles.

The intertransversales muscles.

The first two layers of muscles of the back comprise those muscles which connect the upper limb to the trunk posteriorly. They are therefore considered, along with the associated structures, with the upper limb.

The Third Layer of Muscles of the Back.—This layer consists of two extremely thin muscular sheets, the *serratus posticus superior* and the *serratus posticus inferior* muscles. Associated with these two muscles is the *vertebral aponeurosis*.

The Serratus Posticus Superior Muscle.—This, the smaller of the two muscular sheets, is situated in the upper dorsal region.

Origin.—By a thin aponeurotic tendon from the ligamentum nuchæ, the spine of the last cervical vertebra, the spines of the upper two or three dorsal vertebræ, and their supra-spinous ligaments.

Insertion.—The muscular fibres run obliquely downwards and outwards to be inserted by four digitations into the upper borders and external surfaces of the second, third, fourth, and fifth ribs, just in front of the angles.

Nerve Supply.—The upper intercostal nerves.

The Serratus Posticus Inferior Muscle.—This, the larger of the two muscular sheets is situated in the lower dorsal region.

Origin.—By a thin aponeurotic tendon which forms part of the posterior lamella of the lumbar aponeurosis, from the

spines of the last two dorsal and upper two or three lumbar vertebræ.

Insertion.—The muscular fibres run obliquely upwards, forwards, and outwards, to be inserted by four digitations into the lower borders of the last four ribs.

Nerve Supply.—The lower intercostal nerves.

The Vertebral Aponeurosis.—This is a thin, strong sheet of fascia which bridges across the interval between the spines of the dorsal vertebræ and those portions of the ribs which lie internal to their angles.

It may be regarded as an upward prolongation of the posterior lamella of the lumbar aponeurosis, and it separates, in the dorsal region, those first two layers of the muscles of the back which connect the upper limb to the trunk posteriorly, from those deeper muscles of the back which support the spine and head.

Below, the vertebral aponeurosis fuses with the posterior lamella of the lumbar aponeurosis and the muscles which arise from it. It is, therefore, in the same plane as the serratus posticus inferior.

Above, the vertebral aponeurosis passes upwards in front of the serratus posticus superior, to become lost amongst the deeper intermuscular processes from the deep cervical fascia.

Internally, the vertebral aponeurosis is attached to the spines of the dorsal vertebræ.

Externally, the vertebral aponeurosis is attached to the angles of the ribs.

The Lumbar Aponeurosis.—The lumbar aponeurosis is the posterior aponeurosis of origin, in the lumbar region, of the transversalis abdominis muscle.

It extends from the last rib above to the ilio-lumbar ligament and iliac crest below. It consists of three layers, known as the anterior, middle, and posterior lamellæ respectively, of the lumbar aponeurosis.

The *posterior lamella* is attached to the tips of the spines of the lumbar vertebræ and the intervening supraspinous ligaments. This lamella gives origin to the internal oblique, latissimus dorsi, and serratus posticus inferior muscles.

The *middle lamella* is attached to the tips of the transverse processes of the lumbar vertebræ, and also extends inwards between them to be attached to their contiguous borders.

The *anterior lamella* is attached to the bodies of the lumbar vertebræ close to the pedicles.

Between the three lamellæ of the lumbar aponeurosis two compartments are formed, anterior and posterior.

The *posterior compartment* lodges the erector spinæ muscle.

The *anterior compartment* lodges the quadratus lumborum muscle.

The Fourth Layer of Muscles of the Back.—This layer comprises the splenius capitis et colli muscle, and the erector spinæ muscle with its three columns of subsidiary muscles.

The Splenius Capitis et Colli Muscle.—The splenius capitis et colli is a large flat muscle occupying the total length of the neck and the upper part of the back.

Origin.—From the lower half of the ligamentum nuchæ, from the spine of the seventh cervical vertebra, and from the spines of the upper six dorsal vertebræ.

Insertion.—From the foregoing origin the muscle passes upwards and outwards, and divides into two parts, a cervical and a cranial portion.

(a) The *splenius colli* is inserted into the posterior tubercles of the transverse processes of the first four cervical vertebræ, the insertion of this part of the muscle corresponding to the origin of the levator anguli scapulæ muscle.

(b) The *splenius capitis* is inserted into the outer third of the superior curved line of the occipital bone, and into the outer part of the mastoid process, the insertion of this part of the muscle closely corresponding to that of the sternomastoid muscle.

Nerve Supply.—The posterior primary divisions of the cervical and dorsal nerves.

The Erector Spinæ Muscle.—This is a long powerful muscle which extends along the whole length of the spinal column from the pelvis to the head.

Origin.—Below, the erector spinæ appears as a thick muscular mass, situated in the posterior compartment of the lumbar aponeurosis, with the following origin:—

1. From the spines of the last two dorsal, and all the lumbar and sacral vertebræ, and from their supraspinous ligaments.
2. From the dorsal surface of the sacrum, and from the posterior sacro-coccygeal ligament.
3. From the posterior fifth of the iliac crest.

Insertion.—As the erector spinæ muscle proceeds upwards it breaks up into three columns. These columns may be regarded to a certain extent as the insertion of the muscle.

Each column is composed of certain subsidiary muscular slips. These columns, their component parts, and their *general* attachments, are as follows:—

1. The outer column.—Into angles of ribs.
The ilio-costalis.
The musculus accessorius.
The cervicalis ascendens.
2. The middle column.—Into transverse processes of vertebræ.
The longissimus dorsi.
The transversalis cervicis.
The trachelo-mastoid.
3. The inner column.—Into spinous processes of vertebræ.
The spinalis dorsi.

The Ilio-Costalis Muscle.—This muscle becomes apparent opposite the last rib; the line of demarcation between it and the longissimus dorsi in the middle column is formed by the external branches from the posterior primary divisions of the lower dorsal nerves.

The ilio-costalis muscle is *inserted* into the angles of the lower six ribs.

The Musculus Accessorius.—This muscle is the upward prolongation of the ilio-costalis.

It *arises* from the angles of the lower six ribs.

It is *inserted* into the angles of the upper six ribs and into the transverse process of the seventh cervical vertebra.

The Cervicalis Ascendens Muscle.—This muscle is the prolongation into the neck of the outer column of the erector spinæ muscle.

It *arises* from the angles of the third, fourth, fifth, and sixth ribs.

It is *inserted* into the posterior tubercles of the transverse processes of the fourth, fifth, and sixth cervical vertebræ.

The Longissimus Dorsi Muscle.—This muscle runs upwards in the middle column as high as the first dorsal vertebra; it is the longest and largest of the three divisions into which the erector spinæ divides, and presents for examination two series of insertions.

(a) *The Inner Row of Insertions.*—The inner row of insertions of the longissimus dorsi is by a series of rounded tendons into the accessory processes of the lumbar vertebræ, and into the tips of the transverse processes of all the dorsal vertebræ.

(b) *The Outer Row of Insertions.*—The outer row of insertions of the longissimus dorsi is by a series of fleshy processes into the whole length of the transverse processes of the lumbar vertebræ, and beyond these into the middle lamella of the lumbar aponeurosis; in the dorsal region, the fleshy processes are inserted into the lower nine or ten ribs between the tuberosities and the angles.

The Transversalis Cervicis Muscle.—This muscle is the upward prolongation of the longissimus dorsi.

It *arises* from the transverse processes of the upper four or five dorsal vertebræ.

It is *inserted* into the posterior tubercles of the transverse processes of all the cervical vertebræ, except the first and the last.

The Trachelo-Mastoid Muscle.—This muscle is the prolongation to the head of the middle column of the erector spinæ.

It *arises* from the transverse processes of the upper three or four dorsal vertebræ, and from the articular processes of the lower three or four cervical vertebræ.

From this origin the trachelo-mastoid passes upwards, as a thin flat muscle, to be *inserted* into the posterior border of

the mastoid process, where it is concealed by the splenius capitis and sterno-mastoid muscles.

The Spinalis Dorsi Muscle.—This muscle represents the inner column of the erector spinæ. It is usually difficult to define, and is always the shortest and weakest of the three columns into which the erector spinæ divides.

It *arises* in intimate association with, and on the inner side of, the longissimus dorsi, from the spines of the first two lumbar and last two dorsal vertebræ.

It is *inserted* into the spines of a varying number of the upper dorsal vertebræ, from four to nine, and is closely blended with the subjacent semispinalis dorsi muscle.

The Occipital Artery.—That portion of the occipital artery which is sometimes referred to as its *second part*, may be considered with the present dissection.

The occipital artery arises in the carotid portion of the anterior triangle of the neck from the external carotid. It passes backwards internal to the mastoid process and the sterno-mastoid muscle, and, appearing at the apex of the posterior triangle, ascends to the scalp. The artery may, therefore, be divided into three parts, by the mastoid process and sterno-mastoid muscle:—

1. A first part in front of the sterno-mastoid muscle.
2. A second part internal to the sterno-mastoid muscle.
3. A third part behind the sterno-mastoid muscle.

1. *The First Part of the Occipital Artery.*—This part of the vessel represents its origin. It lies in the carotid portion of the anterior triangle, and is there described. (See page 75.)

2. *The Second Part of the Occipital Artery.*—The second part of the occipital artery is very deeply situated. It runs backwards along the skull, lying in the occipital groove of the temporal bone.

To the *outer* side of the second part of the occipital artery there are, from without inwards, the following structures:—

The sterno-mastoid muscle.

The splenius capitis muscle.

The trachelo-mastoid muscle.

The mastoid process.

The posterior belly of the digastric muscle.

To the *inner* side of the second part of the occipital artery there are the following muscles:—

The rectus capitis lateralis.

The obliquus capitis superior.

The complexus.

Branches.—The second part of the occipital artery gives off the following branches:—

Muscular.

Mastoid.

The arteria princeps cervicis.

(a) *Muscular Branches.*—Muscular branches are given off to the adjacent muscles, and one of larger size to the sternomastoid. This *artery to the sterno-mastoid* is very constantly present, but varies considerably in its origin, as it is not unusual to find it arising from the external carotid instead of from the first or second parts of the occipital artery.

(b) *The Mastoid Branch.*—The mastoid artery enters the skull through the mastoid foramen, and supplies the diploe and the dura mater.

(c) *The Arteria Princeps Cervicis.*—This vessel is specially intended for the supply of the muscles at the upper and posterior part of the neck. It descends for a short distance and divides into a superficial and a deep division.

The *superficial division* descends behind the complexus muscle, and supplies the splenius and trapezius muscles.

The *deep division* descends in front of the complexus muscle. It anastomoses with the vertebral and cervical arteries.

3. *The Third Part of the Occipital Artery.*—This part of the vessel has been described with the Scalp. (See page 9.)

The Fifth Layer of Muscles of the Back.—This layer consists of the large complexus muscle, and the small and unimportant semispinalis colli et dorsi and multifidus spinæ muscles.

The Complexus Muscle.—This muscle occupies the upper dorsal and cervical regions. It conceals from view the suboccipital triangle, and is, in its turn, usually entirely concealed by the splenius capitis et colli muscle.

The complexus arises by tendinous slips from the trans-

verse processes of the seventh cervical and upper six dorsal vertebræ, and from the articular processes of the fourth, fifth, and sixth cervical vertebræ.

The complexus is *inserted* into the large, oval, and internal impression between the two curved lines of the occiput and close to the external occipital crest.

The complexus muscle becomes narrower as it ascends, and it is separated from its fellow of the opposite side by the *ligamentum nuchæ*.

The innermost portion of the complexus is not infrequently partially separated from the rest of the muscle by a long, thin tendon, and is therefore sometimes specially named the *biventer cervicis*.

The Semispinalis Colli et Dorsi Muscle.—This muscle consists of bundles of fibres stretching from transverse processes to spines and crossing over from four to six vertebræ.

(a) *The semispinalis dorsi* is composed of a series of muscular slips with long tendons at each end, which *arise* from the transverse processes of the sixth to the tenth dorsal vertebræ, and are *inserted* into the spines of the last two cervical and first four or six dorsal vertebræ.

(b) *The semispinalis colli* is concealed by the complexus. It *arises* from the transverse processes of the upper five or six dorsal vertebræ, and is *inserted* into the spines of the second to the fifth cervical vertebræ.

The Multifidus Spinæ Muscle.—This muscle occupies the vertebral groove on either side of the spinous processes of the vertebræ. It is concealed by the semispinalis, and extends from the sacrum to the axis.

The *origin* of the multifidus spinæ differs in the different spinal regions as follows:—

(a) *In the sacral region*, the multifidus spinæ arises from:—

The tendinous origin of the erector spinæ muscle.

The dorsal surface of the sacrum as low as the fourth posterior sacral foramen.

The posterior superior iliac spine.

The posterior sacro-iliac ligament.

(b) *In the lumbar region*, the muscle arises from the mammillary processes of the lumbar vertebræ.

(c) *In the dorsal region*, the multifidus spinæ arises from the transverse processes of the dorsal vertebræ.

(d) *In the cervical region*, the muscle arises from the articular processes of the four lower cervical vertebræ.

The *insertion* of the multifidus spinæ muscle is into the whole length of the spinous processes of all the movable vertebræ as high up as the axis.

The muscular fibres from each point of origin are inserted into several vertebræ, some being inserted into the spine of the vertebra next but one above the particular point of origin, and others ascending to their insertion over two, three, or four vertebræ.

The Posterior Primary Divisions of the Spinal Nerves.

—The cutaneous distribution of the posterior primary divisions of the spinal nerves has already been described.

The deeper relations of these nerve trunks may now be examined. It must be remembered that the nerves of the back are the posterior primary divisions of the thirty-one pairs of spinal nerves, and that all these divide into an inner and an outer branch, with four exceptions, as previously mentioned. (See page 12.)

Cervical Nerves.—The cervical nerves are eight in number. The posterior primary division of *the first cervical or suboccipital nerve* is deeply situated in the suboccipital triangle, and is there described. (See page 34.)

The posterior primary division of *the second cervical nerve* is very large, and makes its appearance between the neural arches of the atlas and axis vertebræ.

(a) The *internal* branch of this nerve is termed the *great occipital nerve*. It appears at the lower border of the inferior oblique muscle, and ascends behind that muscle. It is transmitted to the surface through the complexus and trapezius muscles, giving twigs to the former. The further course of this nerve has already been described. (See page 11.)

(b) The *external* branch of the posterior primary division of the second cervical nerve is the largest of the series of external branches from the cervical nerves. Like all its fellows it is purely muscular and supplies the splenius, cervicalis ascendens, transversalis cervicis, and the trachelo-mastoid.

The posterior primary divisions of the *third, fourth, fifth, sixth, seventh, and eighth cervical nerves* arise from the corresponding spinal nerve trunks in the intervertebral foramina, and, turning backwards, appear in the intervals between the transverse processes of the cervical vertebræ.

(a) The *internal* branches are not all distributed alike, nor are their relations the same.

Those from the *third, fourth, and fifth* nerves pass inwards between the semispinalis colli and complexus muscles, supplying both these muscles and also the multifidus spinæ; and then, having reached the spines of the vertebræ, they turn backwards, to become cutaneous by piercing the splenius and trapezius muscles. From the third nerve the cutaneous offset, known as the *occasional third occipital*, is sometimes derived.

The internal branches from the *sixth, seventh, and eighth* cervical nerves run inwards in front of the semispinalis colli muscle, and therefore at a still deeper level than those from the third, fourth, and fifth nerves. They terminate in the semispinalis colli muscle, and thus, contrary to the rule, supply no skin.

(b) The *external* branches from the posterior primary divisions of the *third, fourth, fifth, sixth, seventh, and eighth* cervical nerves supply muscles only. They are distributed to the splenius, cervicalis ascendens, transversalis cervicis, and the trachelo-mastoid.

Dorsal Nerves.—The posterior primary divisions of the dorsal nerves make their appearance between the transverse processes. They all divide into inner and outer branches.

(a) The *internal* branches of the *upper six* dorsal nerves pass inwards between the multifidus spinæ and semispinalis muscles, both of which they supply, and then turn backwards to become cutaneous. They pierce the splenius, rhomboidei, and trapezius muscles in their course to the skin.

The *internal* branches from the *lower six* dorsal nerves lie between the multifidus spinæ and longissimus dorsi muscles. They terminate in the multifidus spinæ muscle, and supply no branches to the skin.

(b) The *external* branches from the *upper six* dorsal nerves pass outwards in front of the middle column of the erector

spinæ muscle, and then turn backwards in the interval between the middle and outer columns of that muscle. They supply the levatores costarum muscles and the muscles of the middle and outer columns of the erector spinæ.

The *external* branches from the *lower six* dorsal nerves are larger than those from the upper six, and contain both motor and sensory fibres. They supply the same muscles as the upper six dorsal nerves, and become cutaneous, by piercing the serratus posticus inferior and the latissimus dorsi muscles, in a line with the angles of the ribs.

Lumbar Nerves.—The *internal* branches of the posterior primary divisions of the five lumbar nerves wind backwards in grooves just below the mammillary processes of the lumbar vertebræ, and terminate in the multifidus spinæ muscle, which they supply.

The *external* branches supply the erector spinæ and lumbar intertransversales muscles. The upper three also give off large cutaneous branches, which pierce the posterior lamella of the lumbar aponeurosis and pass to the skin of the buttock.

Sacral Nerves.—The posterior primary divisions of the first four sacral nerves emerge at the posterior sacral foramina, that from the fifth sacral nerve appears at the lower end of the sacral canal.

The posterior primary divisions of *the first three sacral nerves* divide into inner and outer branches.

(a) The *inner* branches are very small, and terminate in the multifidus spinæ muscle, which they supply.

(b) The *outer* branches form a series of loops upon the dorsal surface of the sacrum from which the cutaneous sacral nerves of the buttock are derived. These loops communicate above with the last lumbar nerve, and below with the fourth sacral nerve.

The posterior primary divisions of *the fourth and fifth sacral nerves* do not divide into inner and outer branches. They supply the dorsal aspects of the coccyx and lower end of the sacrum.

Coccygeal Nerve.—The posterior primary division of *the single coccygeal nerve* emerges at the lower end of the

sacral canal. It does not divide into inner and outer branches, but is distributed to the back of the coccyx.

The Arteries of the Back.—The arteries of the back are very unimportant. They differ in the various regions, and may be summarised as follows:—

(a) *Cervical Region.*

1. The second part of the occipital artery.
2. The *arteria princeps cervicis*, a branch of the second part of the occipital.
3. The *arteria profunda cervicis*, or the deep cervical artery, from the superior intercostal branch of the second part of the subclavian.
4. Muscular branches from the vertebral artery, a branch of the first part of the subclavian.

(b) *Dorsal Region.*

5. The posterior or dorso-spinal branches from the superior intercostal artery from the second part of the subclavian.
6. The posterior or dorso-spinal branches from the nine pairs of aortic intercostals from the descending thoracic aorta.

(c) *Lumbar Region.*

7. The dorsal branches from the lumbar arteries from the abdominal aorta.

(d) *Sacro-coccygeal Region.*

8. Small branches from the lateral sacral arteries from the internal iliac.

1. *The second part of the occipital artery.*

2. *The arteria princeps cervicis.*

Both of these vessels have already been described. (See pages 20 and 21.)

3. *The Deep Cervical Artery.*—The *arteria profunda cervicis*, or the deep cervical artery, is a branch of the superior intercostal artery from the second part of the subclavian.

From its origin the deep cervical artery passes backwards in the interval between the transverse process of the seventh cervical vertebra and the first rib. Having reached the back of the neck, the artery ascends, between the *semispinalis colli* and *complexus* muscles, as high as the axis vertebra.

Branches.—A small *spinal* branch enters the spinal canal with the eighth cervical nerve.

Muscular branches supply the muscles of the neck.

Anastomotie branches to the vertebral, *arteria princeps cervicis*, and ascending cervical arteries.

4. *Muscular Branches from the Vertebral Artery.*—The vertebral artery, in its upward course through the vertebrarterial foramina of the cervical vertebræ, gives off muscular branches to the deep-seated cervical muscles.

5 and 6. *The Posterior or Dorso-Spinal Branches from the Various Intercostal Arteries.*—The posterior or dorso-spinal branches of the various intercostal arteries pass backwards on the inner side of the superior costo-transverse ligaments accompanied by the posterior primary division of the corresponding dorsal nerve. They give off a *spinal* branch to the spinal cord and its coverings, and then, having reached the muscles of the back, terminate by dividing into internal and external branches.

(a) The *internal* branch passes through the multifidus spinæ muscle towards the spinous processes of the vertebræ, and supplies the muscles and the skin.

(b) The *external* branch passes outwards in front of the longissimus dorsi muscle, and then turns backwards between that muscle and the ilio-costalis muscle, both of which it supplies. A few filaments are also given off to the superficial muscles and the skin.

7. *The Dorsal Branches from the Lumbar Arteries.*—The dorsal branches from the abdominal lumbar arteries closely resemble those from the intercostal arteries. They give off a *spinal* branch to the spinal cord and its coverings, and then pass backwards between the transverse processes of the lumbar vertebræ with the posterior primary divisions of the corresponding lumbar nerves, to terminate in small vessels which supply the muscles and skin of the lumbar region.

8. *Small Branches from the Lateral Sacral Arteries.*—The lateral sacral arteries, derived from the internal iliac arteries, give off a small series of branches which run backwards through the anterior sacral foramina, supply the sacral canal,

and then, emerging at the posterior sacral foramina, supply the muscles and skin on the back of the sacrum.

The Veins of the Back.—The venous blood of the back is returned into the general circulation by means of three principal channels:—

1. The occipital veins.
2. The deep cervical vein.
3. The dorsal spinal venous plexus.

1. *The Occipital Veins.*—The occipital veins, usually two or three in number, pass from the scalp, and, descending with the occipital artery, run deeply between the muscles of the back of the neck, to terminate in the commencement of the *deep cervical vein*.

2. *The Deep Cervical Vein.*—This is a large vein which commences in the suboccipital region, and descends to the lower part of the neck between the complexus and semi-spinalis colli muscles. It turns forwards below the transverse process of the seventh cervical vertebra to terminate in the vertebral vein.

Tributaries.—The deep cervical vein receives the occipital veins, venous tributaries from the deep parts of the back of the neck, and also establishes numerous communications with the dorsal spinal venous plexus.

3. *The Dorsal Spinal Venous Plexus.*—This is a venous plexus which is found upon the posterior surfaces of the laminae of the vertebrae, immediately in front of the multifidus spinæ muscle.

This plexus drains the integuments and muscles of the back, and pours its blood into the vertebral veins and into the posterior tributaries of the intercostal and lumbar veins. It also communicates with the posterior longitudinal veins within the spinal canal.

In the dorsal and lumbar regions some of the veins which accompany the arteries terminate *directly* in the intercostal and lumbar veins, instead of *indirectly* by means of the dorsal spinal venous plexus, as just described.

The Sixth Layer of Muscles of the Back.—This layer consists of:—

The rotatores dorsi muscles.

The interspinales muscles.

The intertransversales muscles.

With this layer the levatores costarum muscles may also be described.

The Rotatores Dorsi Muscles.—The rotatores dorsi muscles are situated in the dorsal region, and are eleven in number on each side. They may be regarded as the deepest fibres of the multifidus spinæ, from which they may be distinguished by their more nearly horizontal course.

Each one of the rotatores dorsi muscles *arises* from the upper and posterior part of the transverse process of a dorsal vertebra, and is *inserted* into the lower border of the lamina of the dorsal vertebra immediately above.

The Interspinales Muscles.—The interspinales are a group of short, vertical, and paired muscles lying between the spinous processes of the cervical, dorsal, and lumbar vertebræ. They are best marked in the lumbar region, and least so in the dorsal region.

The Intertransversales Muscles.—The intertransversales are a group of short, almost vertical muscles lying between the transverse processes of the cervical, dorsal, and lumbar vertebræ. They are best marked in the lumbar region, where there are often two sets of muscles between the various transverse processes, and least marked in the dorsal region.

The Levatores Costarum Muscles.—The levatores costarum muscles are situated in the dorsal region, and are twelve in number on each side.

They are small fan-shaped muscles which *arise* by their apices from the transverse processes of the seventh cervical and upper eleven dorsal vertebræ.

Passing downwards and outwards, and enlarging as they descend, they are *inserted* by their bases into the external surface of the rib immediately below their individual origins, between the tuberosity and the angle.

The levatores costarum muscles correspond in their direction to, and become fused externally with, the external intercostal muscles of the thoracic wall.

Functional Uses of the Muscles of the Back.—Regarded from a physiological standpoint, rather than from the purely

anatomical, the muscles of the back become much more interesting.

The muscles of the back, as regards their functions, fall naturally into three main groups:—

1. Those muscles acting upon the upper limb.

(a) The muscles of the first layer.

(1) The trapezius muscle.

(2) The latissimus dorsi muscle.

(b) The muscles of the second layer.

(1) The levator anguli scapulæ muscle.

(2) The rhomboideus minor muscle.

(3) The rhomboideus major muscle.

2. Those muscles acting solely upon the ribs.

(c) The muscles of the third layer.

(1) The serratus posticus superior muscle.

(2) The serratus posticus inferior muscle.

3. Those muscles acting upon the spinal column and head.

(d) The muscles of the fourth layer.

(e) The muscles of the fifth layer.

(f) The muscles of the sixth layer.

1. Those Muscles acting upon the Upper Limb.—The first two layers of muscles of the back act solely upon the clavicle, scapula, and humerus, that is, upon the upper limb. It is for this reason that these muscles are always dissected and studied in connection with the upper limb.

2. Those Muscles acting solely upon the Ribs.—The third layer of muscles of the back—the serratus posticus superior and inferior—act solely upon the ribs, and are therefore closely related to the thoracic muscles. Theoretically they should be dissected and described with the thorax, but in actual practice this is found to be impossible.

3. Those Muscles acting upon the Spinal Column and Head.—These muscles comprise the third, fourth, fifth, and sixth layers. They occupy a very definite area, which is bounded as follows:—

Above, by the superior curved line of the occiput and the mastoid process.

Below, by the lower part of the sacrum.

Internally, by the vertebral spines.

Externally, by the transverse processes of the cervical vertebræ, the angles of the ribs, and the crest of the ilium.

These muscles exercise a double function, for they not only control the various movements of the spinal column and head, but also support the body in the erect attitude.

For the latter purpose the various muscles are arranged in a remarkable series of vertical and oblique columns, capable of supporting weight and resisting pressure and tension. An analysis of the direction of the various muscles which thus support the spinal column and head, shows this to be the case :—

1. Running longitudinally between corresponding vertebræ or ribs—

- (a) Of considerable length and passing over several segments—

The erector spinæ and its columns.

- (b) Short, and attached to adjacent vertebræ—

The interspinales.

The intertransversales.

2. Running obliquely upwards and outwards from spines to transverse processes—

The splenius capitis et colli.

3. Running obliquely upwards and inwards from transverse processes to spines—

The complexus.

The semispinalis colli et dorsi.

The multifidus spinæ.

Nerve Supply to the Six Layers of Muscles of the Back.—The classification of the muscles of the back, from the nature of their actions into three great groups, is still further borne out by their nerve supplies.

1. *Those muscles acting solely upon the upper limb* are supplied almost entirely by the limb nerves, that is, by branches from the anterior primary divisions of the cervical spinal nerves.

2. *Those muscles acting solely upon the ribs*, that is to say, the purely thoracic muscles, are supplied by the intercostal nerves in the thoracic wall, that is, by the anterior primary divisions of the dorsal nerves.

3. *Those muscles acting upon the spinal column and head* are all supplied by the posterior primary divisions of the spinal nerves.

III. THE SUBOCCIPITAL TRIANGLE

The Suboccipital Triangle.—The suboccipital triangle is a small triangle lying immediately below the occipital bone, and concealed from view by the complexus muscle.

Boundaries.—The *lateral* boundaries of the suboccipital triangle are formed very definitely by certain muscles as follows:—

Above and to the Inner Side.—By the rectus capitis posticus major muscle.

Above and to the Outer Side.—By the obliquus capitis superior muscle.

Below.—By the obliquus capitis inferior muscle.

The Floor.—The floor of the suboccipital triangle is formed from above downwards by:—

The posterior occipito-atlantal ligament.

The posterior arch of the atlas.

The Roof.—The roof is formed by the complexus muscle, which must be removed in order to expose the triangle.

Contents.—The contents of the suboccipital triangle are:—

A small part of the vertebral artery.

The posterior primary division of the first cervical or suboccipital nerve.

The Rectus Capitis Posticus Major Muscle.—*Origin.*—By a narrow tendon from the spinous process of the axis vertebra.

Insertion.—The muscle passes upwards and outwards, and, expanding as it proceeds, is inserted into and below the external portion of the inferior curved line of the occipital bone. The insertion of this muscle is partly concealed by that of the obliquus capitis superior muscle.

Nerve Supply.—The posterior primary division of the first cervical or suboccipital nerve.

Action.—The chief action of the rectus capitis posticus

major is rotation of the skull and atlas at the atlanto-axial articulation, thus turning the face over to the same side.

Both muscles acting together draw the head backwards.

The Rectus Capitis Posticus Minor Muscle.—This is a small fan-shaped muscle which lies to the inner side of the rectus capitis posticus major muscle, and takes no part whatsoever in the formation of the suboccipital triangle.

Origin.—From the tubercle on the posterior arch of the atlas.

Insertion.—The muscle passes upwards, and, expanding somewhat, is inserted into the inner third of the inferior curved line of the occipital bone, and the area between this and the foramen magnum.

Nerve Supply.—The posterior primary division of the first cervical or suboccipital nerve.

Action.—The rectus capitis posticus minor extends the head at the occipito-atlantal articulation.

Relations.—The rectus capitis posticus minor muscle lies to the inner side of, and at a deeper plane than, the major muscle. It conceals part of the posterior occipito-atlantal ligament, and the two muscles together correspond to the interspinales muscles of the sixth layer of the back.

The Obliquus Capitis Superior Muscle.—*Origin.*—From the upper surface of the transverse process of the atlas.

Insertion.—The muscle passes obliquely upwards, backwards, and inwards, and, expanding somewhat, is inserted into the outer part of the space between the superior and inferior curved lines of the occiput.

Nerve Supply.—The posterior primary division of the first cervical or suboccipital nerve.

Action.—The obliquus capitis superior extends the head at the occipito-atlantal articulation.

The Obliquus Capitis Inferior Muscle.—This is the most powerful of the suboccipital muscles.

Origin.—From the spinous process of the axis immediately below the origin of the rectus capitis posticus major.

Insertion.—It passes obliquely outwards, upwards, and forwards, to be inserted into the lower and back part of the transverse process of the atlas.

Nerve Supply.—The posterior primary division of the first cervical or suboccipital nerve.

Action.—The principal action of the obliquus capitis inferior is powerful rotation of the skull and atlas at the atlanto-axial articulation, thus turning the face over to the same side.

The Vertebral Artery.—Only a very small part of the vertebral artery is seen in the suboccipital triangle.

In this part of its course the vertebral artery emerges at the vertebrarterial foramen in the transverse process of the atlas, and then runs backwards and inwards in the vertebral groove upon the superior surface of its posterior arch.

The vessel leaves the suboccipital triangle by passing forwards below the posterior occipito-atlantal ligament, and, piercing the dura mater and arachnoid, it turns upwards and forwards in the subarachnoid space, and enters the skull through the foramen magnum.

This part of the vertebral artery gives off small *muscular* branches to the surrounding suboccipital muscles, and branches which *anastomose* with the arteria princeps cervicis and with the deep cervical artery.

The Posterior Primary Division of the First Cervical or Suboccipital Nerve.—The posterior primary division of the first cervical or suboccipital nerve appears in the suboccipital triangle above the posterior arch of the atlas, between it and the vertebral artery; it does not divide into internal and external branches, but supplies the various muscles of the suboccipital region.

Branches.—The branches of the posterior primary division of the first cervical or suboccipital nerve are as follows:—

Muscular branches to—

The rectus capitis posticus major.

The rectus capitis posticus minor.

The obliquus capitis superior.

The obliquus capitis inferior.

The complexus.

Communicating branch to—

The great occipital nerve.

IV. THE DISSECTION OF THE NECK

Boundaries.—The side of the neck is somewhat irregularly quadrilateral in outline, and is bounded as follows:—

Above, by the lower jaw and an imaginary line prolonging that backwards.

Below, by the clavicles.

In front, by the middle line of the neck—that is, by the line at which the mesial plane of the body meets the surface.

Behind, by a line drawn from the occiput to the acromial end of the clavicle, this line being almost identical with the anterior border of the trapezius muscle.

Regions.—The dissection of the neck includes three most important anatomical and surgical regions, as follows:—

A. The posterior triangle.

B. The anterior triangle.

C. The middle line of the neck.

The Superficial Fascia.—The superficial fascia in the neck is peculiar because it contains a thin superficial muscle, the *platysma myoides*. This muscle is the representative in man of a fleshy subcutaneous muscular sheet which is present in some of the lower animals, and is known as the *panniculus carnosus*.

The fatty tissue found in the superficial fascia of the neck is always better marked in the female and in children than in the male, and in both sexes is best developed between the chin and the hyoid bone, producing, when exceptionally well marked, “double chin.”

The superficial fascia of the neck contains the following important subcutaneous structures:—

1. The platysma myoides muscle.
2. The external jugular vein.
3. The anterior jugular vein.
4. The superficial cervical glands.
5. The superficial branches of the cervical plexus.

The Platysma Myoides Muscle.—This muscle is a subcutaneous muscular sheet lying in the superficial fascia over the sides and front of the neck. It is the equivalent of the

muscular subcutaneous sheet found in some of the lower animals and termed the *panniculus carnosus*.

The platysma myoides is superficial to those cutaneous nerves from the cervical plexus which eventually pierce the muscle in order to reach the skin. It is also superficial to the external jugular vein, a point of some practical importance in venesection upon this vein, as the fibres of the muscle will require to be cut through to reach the vein.

Origin.—From the skin and subcutaneous tissue over the upper parts of the deltoid and pectoralis major muscles.

Insertion.—The muscular fibres pass upwards and inwards in front of the clavicle and acromion process to be inserted into the outer surface of the lower jaw from the mental protuberance to the masseter muscle, and into the angle of the mouth.

Nerve Supply.—The infra-mandibular branch of the facial nerve.

Action.—The platysma pulls down the angle of the mouth, or elevates the skin over the shoulder. The action of the muscle is typically seen in the expression of sudden terror.

Relations.—The platysma myoides lies in the superficial fascia, and is therefore only covered by skin. Deeper than the muscle are the external jugular vein and the six cutaneous nerves of the region, which eventually pierce the muscle to reach the skin.

It is important to remember the order of these various structures in this region, which is as follows:—

Skin, superficial fascia containing the platysma myoides, the cutaneous nerves and veins, and the deep fascia forming the roof of the two triangles of the neck.

The External Jugular Vein. — The most important superficial vein in this region is the external jugular vein. This vein commences just behind the angle of the lower jaw, by the junction of the posterior division of the temporo-maxillary venous trunk, and the posterior auricular vein.

The vein descends almost vertically along a line drawn from just behind the angle of the jaw to the middle of the clavicle, lying in this course between the platysma myoides and the deep fascia until it reaches a point just above the middle of the clavicle, where it pierces the deep fascia, to

terminate in the subclavian vein. The vein crosses the sterno-mastoid obliquely, but is separated from the muscle by the deep cervical fascia; having crossed the sterno-mastoid, the vein has upon it a swelling, which is limited above and below by a valve.

Tributaries.—The external jugular vein receives several tributaries as follows:—

The occasional posterior external jugular vein.

The anterior jugular vein.

The suprascapular vein.

The transverse cervical vein.

The Occasional Posterior External Jugular Vein, when present, usually drains the occipital region, and terminates in the external jugular vein about half-way down the neck.

The remaining tributaries terminate in the external jugular vein just before it joins the subclavian vein. They form a well-marked venous plexus, which is situated in front of the third part of the subclavian artery, and which is a very important anterior surgical relation of that part of the vessel.

The external jugular vein often communicates, near its origin, with the more deeply situated internal jugular vein.

The Anterior Jugular Vein.—This small vein is a very variable structure which, when present, usually commences in the submaxillary region, by the union of some small venous radicles.

The vein then descends at a variable distance from the middle line of the neck, until it reaches the inner end of the clavicle, immediately above which it pierces the deep fascia, and then turns outwards behind both heads of origin of the sterno-mastoid, to terminate either in the external jugular or in the subclavian vein.

Just above the upper end of the sternum the two anterior jugular veins are usually united together by a small cross vein, and very frequently each anterior jugular vein communicates with the external jugular and with the common facial veins.

The Superficial Cervical Glands. — The superficial cervical glands are a group of from four to six lymphatic glands, which are found along the course of the external

jugular vein between the platysma myoides and the deep cervical fascia.

The Superficial Branches of the Cervical Plexus.—On the sides and front of the neck there are six cutaneous nerves, all of which are branches of the cervical plexus, and which all emerge at the middle of the posterior border of the sterno-mastoid muscle.

The branches of the cervical plexus are divided into *superficial* and *deep*—that is to say, into branches which reach the skin, and which are hence cutaneous branches, and those which do not.

The *superficial* branches form the cutaneous nerves of this region, and they are further subdivided, according to the direction which they take, into *ascending* and *descending*, as follows :—

Superficial branches of the cervical plexus—

Ascending branches—

The small occipital nerve.

The great auricular nerve.

The superficial cervical nerve.

Descending branches—

The supra-sternal nerve.

The supra-clavicular nerve.

The supra-acromial nerve.

All the ascending branches are derived from the second and third nerves of the cervical plexus, and all the descending branches from the third and fourth nerves of the plexus.

The Small Occipital Nerve.—This nerve runs upwards along the posterior border of the sterno-mastoid muscle to the skin of the scalp. The nerve is occasionally doubled.

The Great Auricular Nerve.—This nerve ascends vertically towards the ear, crossing the sterno-mastoid muscle superficially and somewhat obliquely.

It gives off *facial*, *auricular*, and *mastoid* branches. Some of the facial branches enter the substance of the parotid gland, and communicate there with the facial nerve.

The Superficial Cervical Nerve.—This nerve crosses the sterno-mastoid almost horizontally, and passes on to the anterior triangle, where it divides, under cover of the

platysma myoides muscle, into an upper and a lower branch.

The *upper* branch supplies the skin over the upper half of the front of the neck, and communicates with the infra-mandibular branch of the facial nerve.

The *lower* branch supplies the skin as low down as the sternum.

The Supra-Sternal Nerve.—This nerve, the smallest of the three descending branches, descends in front of the sterno-clavicular articulation, to supply the skin over the inner end of the clavicle and the upper part of the sternum. It may also furnish articular filaments to the sterno-clavicular articulation.

The Supra-Clavicular Nerve.—This nerve crosses the middle of the clavicle in the interval between the sternomastoid and trapezius muscles, and supplies the skin in front of the pectoral and deltoid muscles.

The Supra-Acromial Nerve.—This nerve passes downwards and outwards in front of the outer third of the clavicle, to supply the skin over the outer and back part of the shoulder.

The Deep Cervical Fascia.—The general disposition of the deep cervical fascia is best seen in a transverse section through the neck.

In such a section the deep cervical fascia is seen to be attached *posteriorly* to the ligamentum nuchæ. It encloses the trapezius, and at the anterior border of that muscle the two layers which have so enclosed the trapezius unite to form a single layer which roofs in the posterior triangle, and which, on reaching the posterior border of the sternomastoid, again divides to enclose that muscle; at the anterior border these two layers again reunite, and pass round uninterruptedly across the middle line to the anterior border of the sternomastoid of the opposite side, thus roofing in both the anterior triangles, and then passing on to the original starting point at the ligamentum nuchæ.

When traced *upwards*, the deep cervical fascia is found to be attached to the lower border of the body of the lower jaw as far back as the angle. Behind this point it passes upwards, superficial to the parotid gland, to the zygoma,

constituting here the *parotid fascia*, behind which it continues to ascend, to be attached to the pinna, the mastoid process, and the superior curved line of the occiput.

When traced *downwards*, the deep cervical fascia is found to be attached to the sternum, the clavicle, the acromion process and spine of the scapula, whilst between the two scapulæ it passes uninterruptedly downwards to become continuous with the vertebral aponeurosis.

In *the middle line of the neck* the deep cervical fascia receives an additional attachment to the hyoid bone, whilst its attachment to the sternum below is somewhat peculiar, as, on tracing the fascia down in this region, it is found to split into two parts—an *anterior* portion, which descends in front of the sterno-mastoid muscles to be attached to the anterior surface of the manubrium sterni; and a *posterior* and stronger portion, which descends in front of the sterno-hyoid and sterno-thyroid muscles to the interclavicular ligament and the deep surface of the manubrium sterni.

The interval which is thus left between these two portions of the deep cervical fascia is termed the *supra-sternal space*; it contains a small portion of the two anterior jugular veins, the communicating vein between those two veins, the sternal heads of the sterno-mastoids, and some fat and lymphatics.

Processes of the deep Cervical Fascia.—The deep cervical fascia sends numerous processes between the various muscles of the neck. The more important of these processes are—

The prevertebral fascia.

The pretracheal fascia.

The carotid sheath.

The stylo-maxillary ligament.

The fascia of the omo-hyoid muscle.

The Prevertebral Fascia.—This sheet of fascia passes from the deep fascia on the deep surface of the sterno-mastoid muscle, inwards behind the internal jugular vein and the carotid vessels, and in front of the vertebræ and the pre-vertebral muscles.

It divides the neck into two almost equal parts—an

anterior or visceral compartment containing the thyroid body, the larynx and trachea, the pharynx and œsophagus, and the depressor muscles of the hyoid bone; and a *posterior or muscular* compartment, containing the cervical portion of the vertebral column and its surrounding muscles.

Between the prevertebral fascia and the fascia proper of the pharynx—the bucco-pharyngeal fascia—there is a small interval filled with areolar tissue, termed the *retro-pharyngeal space*, which is limited laterally by the carotid sheath. This retro-pharyngeal space is of some practical importance in connection with the subject of retro-pharyngeal abscess.

Laterally, the prevertebral fascia is prolonged outwards and downwards, over the scaleni muscles to form the axillary sheath.

The prevertebral fascia is attached *above*, to the base of the skull, whilst *below* it passes downwards into the thorax in front of the longus colli muscles.

The Pretracheal Fascia.—This sheet of fascia comes off from the deep cervical fascia on the deep surface of the sterno-mastoid near its anterior border. It passes inwards *behind* the depressor muscles of the hyoid bone, and *in front* of the trachea and the thyroid body, thus subdividing the anterior or visceral compartment. It extends downwards in front of the trachea and the great vessels at the root of the neck, as far as the pericardium.

The Carotid Sheath.—The carotid sheath is a fibrous covering for the carotid vessels. It is formed by the fascia on the deep surface of the sterno-mastoid muscle, and by the prevertebral and pretracheal sheets of fascia. It contains the carotid artery, the internal jugular vein, the pneumo-gastric or vagus nerve, and, lastly, the descendens hypoglossi nerve is embedded in its anterior wall.

The Stylo-Maxillary Ligament.—The stylo-maxillary ligament is developed in a process of the deep cervical fascia, which extends upwards between the submaxillary and parotid glands. The stylo-maxillary ligament extends from the styloid process to the angle and posterior border of the ascending ramus of the lower jaw, between the insertions of the masseter and internal pterygoid muscles.

The Fascia of the Omo-Hyoid Muscle.—This is a process of the deep cervical fascia which binds down the intermediate tendon of the omo-hyoid muscle to the clavicle and first rib.

Relations of the Deep Cervical Fascia.—The deep cervical fascia forms the roof of both the anterior and posterior triangles of the neck.

It is pierced at various places by the anterior and external jugular veins, and by the various cutaneous nerves of the region.

The Sterno-Mastoid Muscle.—This muscle forms the division between the anterior and posterior triangles of the neck. Its anterior border forms the posterior boundary of the anterior triangle, and its posterior border the anterior boundary of the posterior triangle; consequently, the various structures which lie under cover of the muscle lie in neither triangle.

Origin.—The sterno-mastoid or the sterno-cleido-mastoid muscle arises by two heads, a sternal head and a clavicular head.

(a) The *sternal* head is thick and rounded, and arises from the upper part of the anterior surface of the manubrium sterni.

(b) The *clavicular* head has a wide fleshy origin, from the inner third of the superior surface of the clavicle. Between the two heads there is a narrow elongated interval.

The two heads pass generally upwards, the sternal head passing backwards as well as upwards, and the clavicular head passing almost vertically upwards, to unite about the middle of the neck.

Insertion.—The muscle is inserted into the anterior border and external surface of the mastoid process, and by a thin aponeurosis into the outer third of the superior curved line of the occiput.

Nerve Supply.—The spinal accessory, or eleventh cranial nerve, and filaments from the second cervical nerve.

Action.—If one sterno-mastoid muscle alone contracts, a triple displacement is produced. The head is inclined laterally towards the same side, the chin is rotated towards the opposite side, and the neck is slightly flexed. This is the

attitude characteristically assumed in wry neck or torticollis, where one sterno-mastoid is contracted.

When both sterno-mastoids contract simultaneously, the head is bent forwards.

Relations.—The *anterior* border of the muscle forms the posterior boundary of the anterior triangle.

The *posterior* border of the muscle forms the anterior boundary of the posterior triangle. Emerging about the middle of the posterior border of the muscle are the six superficial branches of the cervical plexus and the spinal accessory nerve.

The *superficial* surface of the muscle is covered by the skin, the superficial fascia containing the platysma myoides, and the deep fascia. Between the platysma myoides and the deep fascia the muscle is crossed by the external jugular vein, and the nerves previously mentioned.

The *deep* surface has most important relations, as follows:—

It is crossed obliquely from before, backwards and downwards, by the spinal accessory nerve. This nerve reaches the anterior border of the muscle about one inch below the tip of the mastoid process, and, crossing the deep surface of the muscle, reappears at the middle of its posterior border.

Other very important deep relations of the sterno-mastoid are as follows:—

(a) *Behind the Clavicular Head.*—If the clavicular head of the sterno-mastoid be removed, the following structures will be exposed:—

The scalenus anticus muscle, crossed obliquely from without inwards by the phrenic nerve; and more or less transversely by the posterior belly of the omo-hyoid, the transverse cervical artery, and the suprascapular artery.

(b) *Behind the Sternal Head* are the sterno-hyoid and sterno-thyroid muscles, the carotid sheath, and its contents.

A needle passed backwards through the narrow interval between the sternal and clavicular heads, just above the sterno-clavicular articulation, would hit, on the right side, the bifurcation of the innominate artery into the right subclavian and the right common carotid arteries.

(c) *Behind the Middle Part of the Muscle* are the cervical

plexus, and parts of the levator anguli scapulæ, and scaleni muscles.

(*d*) *Concealed by the Insertion of the Muscle* are parts of the splenius and digastric muscles, and the second part of the occipital artery.

Subdivision of the Side of the Neck.—The somewhat quadrilateral area which comprises the side of the neck is crossed diagonally by the sterno-mastoid muscle, which thus divides the space into two important triangles, named from their relations to the sterno-mastoid, anterior and posterior, respectively; each triangle is, in its turn, subdivided into lesser or subsidiary triangles.

A. THE POSTERIOR TRIANGLE

Position.—The posterior triangle occupies the posterior half of the lateral aspect of the neck behind the sterno-mastoid muscle; it is about eight inches in length.

Shape.—The posterior triangle is distinctly triangular in outline with the base below.

Boundaries.—The boundaries of the posterior triangle are as follows:—

The Base.—The base is below, and is formed by the middle third of the clavicle.

The Apex.—The apex is formed at the superior curved line of the occipital bone, by the convergence of the sterno-mastoid and trapezius muscles. In non-muscular subjects these muscles may not meet, in which case the apex will be blunted.

The Anterior Boundary.—The anterior boundary is formed by the posterior border of the sterno-mastoid muscle.

The Posterior Boundary.—The posterior boundary is formed by the anterior border of the trapezius muscle.

The Floor.—The floor of the posterior triangle is a muscular floor. It is formed by the following muscles:—

The splenius capitis et colli muscle.

The levator anguli scapulæ muscle.

The scalenus medius muscle.

The scalenus posticus muscle.

The first digitation of the serratus magnus muscle.

The Roof.—The roof of the posterior triangle is formed by the deep cervical fascia.

Subdivision of the Posterior Triangle.—The posterior triangle is subdivided by means of the posterior belly of the omo-hyoid muscle into two unequal triangles—an upper and larger triangle, the occipital triangle; and a lower, smaller, and more important triangle—the supra-clavicular triangle.

The Occipital Triangle.—The occipital triangle is bounded as follows:—

Below, by the posterior belly of the omo-hyoid muscle which separates this triangle from the supra-clavicular triangle.

In front, by the posterior border of the sterno-mastoid muscle.

Behind, by the anterior border of the trapezius muscle.

Contents.—The contents of the occipital triangle are as follows:—

Nerves.

Branches from the cervical plexus—

- (a) The superficial branches.
- (b) The nerves to the trapezius muscle.
- (c) The nerves to the levator anguli scapulae muscle.

The upper part of the brachial plexus.

The spinal accessory nerve.

Arteries.

The third part of the occipital artery occasionally.

The transverse cervical artery.

Vein.

The transverse cervical vein.

Glands.

Lymphatic glands.

The Supra-Clavicular Triangle.—The supra-clavicular triangle is bounded as follows:—

In front, by the posterior border of the sterno-mastoid muscle. This boundary constitutes the base of the triangle; it is often very short, on account of the omo-hyoid muscle lying lower than usual.

Above, by the posterior belly of the omo-hyoid muscle.

Below, by the middle third of the clavicle.

Contents.—The contents of the supra-clavicular triangle are as follows:—

Nerves.

The brachial plexus and its branches.

Arteries.

The third part of the subclavian artery.

The transverse cervical artery.

The suprascapular artery.

Veins.

The subclavian vein.

The transverse cervical vein.

The suprascapular vein.

The external jugular vein.

Glands.

Lymphatic glands.

The Muscles in the Floor of the Posterior Triangle.

—The muscles in the floor of the posterior triangle are:—

The splenius capitis et colli muscle.

The levator anguli scapulæ muscle.

The scalenus medius muscle.

The scalenus posticus muscle.

The first digitation of the serratus magnus muscle.

With the exception of the scaleni, all the muscles which take part in the formation of the floor of the posterior triangle are described elsewhere.

The Scaleni Muscles.—The scaleni muscles are three in number—anterior, middle, and posterior. They are the deep lateral muscles of the neck, and extend from the transverse processes of the cervical vertebræ to the first and second ribs.

Of the three scaleni muscles, two only, the scalenus medius and the scalenus posticus, take part in the formation of the floor of the posterior triangle of the neck. The scalenus anticus lies altogether behind the clavicular head of origin of the sterno-mastoid muscle, and is, therefore, in neither of the two triangles of the neck. It is, however, a matter of convenience to discuss all three muscles together, more especially as they all belong to the same group—the deep lateral muscles of the neck.

The Scalenus Anticus Muscle.—*Origin.*—The scalenus anticus arises from the anterior tubercles of the transverse processes of all the cervical vertebræ, except the first and the last.

Insertion.—The muscle passes downwards, and slightly outwards, to be inserted into the scalene tubercle on the inner border of the first rib, and into the adjacent part of the upper surface of the same bone, between the two subclavian grooves.

Nerve Supply.—The cervical nerves.

Relations.—The relations of the scalenus anticus are of the greatest importance, as they afford a key to the study of the subclavian region.

It is most important to remember that the scalenus anticus is in neither triangle of the neck, but lies entirely behind the clavicular head of the sterno-mastoid muscle, unless in muscular subjects, when it may project somewhat beyond the sterno-mastoid, and so come to lie in the posterior triangle.

On reflecting the clavicular head of the sterno-mastoid the scalenus anticus will be seen; it presents for examination an anterior and a posterior surface, and an internal and an external border.

The Anterior Surface.—This surface of the muscle lies entirely behind the clavicular head of the sterno-mastoid.

It is crossed obliquely from without inwards by the phrenic nerve, the obliquity of the nerve being more marked on the left side than on the right.

Crossing the muscle, more or less transversely, are the posterior belly of the omo-hyoid muscle, the transverse cervical and suprascapular arteries, and the subclavian vein.

The Posterior Surface.—This surface lies in front of the nerves of the brachial plexus, the second part of the subclavian artery, and the cervical pleura.

The Internal Border.—The internal jugular vein descends almost vertically along the inner border of the scalenus anticus.

Passing upwards along the same border, and behind the vein, is the ascending cervical artery, a branch of the inferior

thyroid artery. This vessel runs upwards in the interval between the inner border of the scalenus anticus and the adjacent rectus capitis anticus major muscle.

The External Border.—The external border is in relation to the prolongation of the cervical fascia, which passes outwards with the subclavian artery to form the axillary sheath. On removing this fascia, the nerves of the brachial plexus and the third part of the subclavian artery are seen making their appearance at this border of the muscle.

The Scalenus Medius Muscle.—*Origin.*—From the posterior tubercles of the transverse processes of all the cervical vertebræ.

Insertion.—Into the rough impression on the upper surface of the first rib which extends from the tuberosity of the rib to the groove for the subclavian artery.

Nerve Supply.—The cervical nerves.

Relations.—In front of this muscle, and therefore between it and the scalenus anticus, are the nerves of the brachial plexus and the subclavian artery.

Immediately behind the muscle are parts of the levator anguli scapulæ and scalenus posticus muscles.

The Scalenus Posticus Muscle.—*Origin.*—From the posterior tubercles of the transverse processes of the lower three cervical vertebræ.

Insertion.—Into the external surface of the second rib, just in front of the insertion of the serratus posticus superior muscle. It is this insertion into the second rib which enables the muscle to be distinguished from the anterior and middle scaleni muscles.

Nerve Supply.—The cervical nerves.

Action of the Scaleni Muscles.—The scaleni muscles are elevators of the upper ribs, and may therefore act as muscles of inspiration. They may also act as flexors of the neck.

The Third Part of the Subclavian Artery.—The third part of the subclavian artery lies in the supra-clavicular triangle, and commences at the outer border of the scalenus anticus muscle, as the direct continuation of the second part of the vessel. It terminates at the outer border of the first rib by becoming directly continuous with the axillary artery.

In this part of its course the subclavian artery is enclosed in that prolongation of the deep cervical fascia which emerges at the outer border of the scalenus anticus, and which eventually forms the axillary sheath.

Relations.—The *anterior* relations of the third part of the subclavian artery are the integumentary coverings, and, near its termination, the clavicle and subclavius muscle.

The external jugular vein and some of its tributaries form a venous plexus in front of the vessel, which is of very considerable practical importance in ligation of this part of the artery.

The suprascapular artery crosses the artery transversely from within outwards, and the small nerve to the subclavius crosses it vertically from above downwards.

The subclavian vein is in front of the artery, but at a slightly lower level.

Behind the artery are the scalenus medius muscle and the pleura. The greater portion of the anterior primary division of the first dorsal nerve ascends behind the artery, to take part in the formation of the brachial plexus.

Below the artery is the first rib, against which this part of the vessel may be compressed digitally.

Above the artery are the remaining nerves of the brachial plexus.

Branches.—The third part of the subclavian artery does not usually give off any branches, though it is not uncommon for the *suprascapular* or the *posterior scapular* arteries to arise from this part of the vessel.

The Subclavian Vein.—The subclavian vein corresponds only to the third and second parts of the artery. It is therefore shorter than the artery.

The subclavian vein commences at the outer border of the first rib, as the direct continuation of the axillary vein, and terminates at the inner border of the scalenus anticus muscle, by uniting with the internal jugular vein to form the innominate vein of the right or left side respectively.

The vein lies throughout, in front of, and at a slightly lower level than the artery, and is separated from the second part of the artery by the scalenus anticus muscle.

Tributaries.—The subclavian vein lies behind the clavicle, and receives the external and anterior jugular veins as tributaries. On the *right* side, at the angle of junction of the subclavian and internal jugular veins, the right lymphatic duct terminates, and, at a similar point on the *left* side, the thoracic duct.

The Thoracic Duct.—The thoracic duct enters the root of the neck from the thorax on the left side of the œsophagus, whereupon it arches forwards, outwards, and downwards upon the cervical parietal pleura, to terminate in the outer angle of junction of the left internal jugular vein with the left subclavian. In this course the thoracic duct passes behind the internal jugular vein, and arching forwards above the first part of the subclavian artery descends in front of that vessel to its termination.

The thoracic duct is the main channel by means of which the lymph and chyle reach the venous system.

The Right Lymphatic Duct.—This small vessel is found on the right side, and corresponds to the thoracic duct. It lies immediately to the inner side of the scalenus anticus muscle, and terminates in the outer angle of junction of the right internal jugular vein with the right subclavian.

It drains the right upper limb, the right side of the head and neck, the right half of the thorax, and the upper surface of the liver.

The Brachial Plexus.—The brachial plexus is formed by the union of the anterior primary divisions of the fifth, sixth, seventh, and eighth cervical nerves, and the greater part of the anterior primary division of the first dorsal nerve. To these are often added filaments from the fourth cervical and second dorsal nerves.

The brachial plexus extends from the neck to the coracoid process of the scapula, where it breaks up into the various nerves of the upper limb.

The brachial plexus is divisible into two parts, a cervical or supra-clavicular portion, which includes the origin and mode of formation of the plexus, and an axillary or infra-clavicular portion.

The *cervical or supra-clavicular portion* makes its appear-

ance between the scalenus anticus and medius muscles. It occupies the lower part of the supra-clavicular triangle, lying behind and above the third part of the subclavian artery.

The *axillary or infra-clavicular portion* is described in connection with the upper limb.

Origin and Mode of Formation of the Brachial Plexus.

—The mode of formation of the brachial plexus may be divided into four stages.

The first stage consists of the anterior primary divisions of the various nerves which go to form the plexus.

The second stage consists of the three trunks which are formed by the union of the five nerves of the first stage.

The third stage consists of six divisions, which result from the division of the three trunks of the second stage.

The fourth stage consists of the three cords of the brachial plexus. Of these four stages, the first three usually lie above the clavicle, and belong therefore to the supra-clavicular portion of the plexus, as follows:—

The supra-clavicular portion—

First stage, five nerves.

Second stage, three trunks.

Third stage, six divisions.

The infra-clavicular portion—

Fourth stage, three cords.

The First Stage.—The first stage consists of the five nerves which form the plexus. These are, the anterior primary divisions of the fifth, sixth, seventh, and eighth cervical nerves, and the greater part of the anterior primary division of the first dorsal nerve, with additional filaments from either the fourth cervical or second dorsal nerves.

This stage terminates speaking generally, at the outer border of the scalenus medius muscle, at which point the five nerves will be found reduced to three trunks. This reduction takes place as follows:—

The fifth and sixth nerves unite at the outer border of the scalenus medius to form the upper trunk.

The seventh nerve passes outwards alone, as the middle trunk.

The eighth cervical and first dorsal nerves unite between the scaleni muscles to form the lower trunk.

The Second Stage.—The second stage consists of the foregoing three trunks. It extends from the outer border of the scalenus medius to a little beyond the scaleni muscles, where it terminates by the division of each one of the three trunks into an anterior and a posterior division, the posterior division from the lower trunk being usually much smaller than the other two.

The Third Stage.—The third stage consists of the six anterior and posterior divisions. It terminates behind the clavicle in the following way:—

The anterior divisions from the upper and middle trunks unite to form the outer cord of the brachial plexus.

The anterior division from the lower trunk passes on alone as the inner cord.

The three posterior divisions unite to form the posterior cord of the plexus.

The Fourth Stage.—The fourth stage consists of the three cords. It constitutes the infra-clavicular or axillary portion of the brachial plexus, and extends from the clavicle to the coracoid process.

Branches.—The branches of the brachial plexus may be classified as follows:—

Supra-clavicular branches—

To the muscles of the trunk—

To the longus colli.

To the scaleni muscles.

A communicating branch to the phrenic nerve.

To the muscles of the upper limb—

The nerve to the rhomboids.

The posterior thoracic nerve, or the external respiratory nerve of Bell.

The supra-scapular nerve.

The nerve to the subclavius muscle.

Infra-clavicular branches—

These branches form the various nerves of the upper limb.

Supra-clavicular Branches of the Brachial Plexus.—

Muscular Branches.—Muscular branches are given off close to the intervertebral foramina, for the supply of the longus colli and scaleni muscles.

The Communicating Branch to the Phrenic Nerve.—This branch usually arises from the fifth cervical nerve, and, when present, joins the phrenic nerve on the anterior surface of the scalenus anticus muscle.

The Nerve to the Rhomboids.—This nerve is derived from the trunk of the fifth cervical nerve close to the intervertebral foramen. It passes backwards through the fibres of the scalenus medius to the vertebral border of the scapula. The nerve lies in front of the levator anguli scapulæ and rhomboid muscles, all of which it supplies.

The Posterior Thoracic Nerve, or the External Respiratory Nerve of Bell.—The posterior thoracic nerve, or the external respiratory nerve of Bell, arises by three roots from the fifth, sixth, and seventh cervical nerves. The upper two roots pierce the scalenus medius muscle, the lowest root passes in front of that muscle to unite with the other two, opposite the first rib. The nerve then descends behind the brachial plexus and the first part of the axillary artery to the outer surface of the serratus magnus, which it supplies.

The Suprascapular Nerve.—The suprascapular nerve arises from the back of the trunk formed by the union of the fifth and sixth nerves of the plexus. It then passes outwards and backwards under cover of the trapezius and posterior belly of the omo-hyoid, to the suprascapular foramen, through which it passes to enter the supraspinous fossa, where it supplies the supraspinatus muscle, and then passing on to the infraspinous fossa through the great scapular notch; it terminates in the substance of the infraspinatus muscle, which it also supplies.

The Nerve to the Subclavius.—The nerve to the subclavius is a very small nerve, which arises from the front of the trunk formed by the junction of the fifth and sixth nerves of the plexus. It descends in front of the third part of the subclavian artery, and behind the clavicle to the deep surface of the subclavius muscle, which it supplies.

The Spinal Accessory Nerve.—The spinal accessory or eleventh cranial nerve appears in the posterior triangle at the middle of the posterior border of the sterno-mastoid muscle. It crosses the triangle obliquely, and, passing downwards and backwards, disappears under cover of the anterior border of the trapezius muscle. It supplies the two muscles which bound the posterior triangle, namely, the sterno-mastoid and the trapezius.

The Cervical Nerves to the Trapezius Muscle.

The Cervical Nerves to the Levator Anguli Scapulæ Muscle.—All these nerves have been described on page 14.

The Lymphatic Glands of the Posterior Triangle.—The lymphatic glands in the neighbourhood of the posterior triangle of the neck are as follows:—

1. The superficial cervical glands.
2. The inferior deep cervical glands.
3. The suboccipital glands.
4. The mastoid glands.

1. *The Superficial Cervical Glands.*—These glands, which have already been briefly mentioned, are a group of from four to six lymphatic glands found along the course of the external jugular vein between the platysma myoides and the deep cervical fascia.

These glands are joined by lymphatic vessels from the following parts:—

- From the external ear.
- From the skin of the neck.
- From the suboccipital glands.
- From the mastoid glands.

Their efferent vessels terminate in the inferior deep cervical glands.

2. *The Inferior Deep Cervical Glands.*—These glands belong chiefly to the anterior triangle, as they are grouped around the internal jugular vein, and only a few extend outwards into the supra-clavicular portion of the posterior triangle. They are fully described on page 80.

3. *The Suboccipital Glands.*—The suboccipital glands are one or two glands quite superficially situated at the apex of the posterior triangle. They drain the most posterior part of

the scalp, and their efferent vessels terminate in the superficial cervical glands.

4. *The Mastoid Glands*.—The mastoid glands are two or three glands which lie superficial to the sterno-mastoid at its insertion. They drain the middle portion of the scalp, and their efferent vessels terminate in the superficial cervical glands.

B. THE ANTERIOR TRIANGLE

Position.—The anterior triangle occupies the anterior part of the lateral aspect of the neck, in front of the sterno-mastoid.

Shape.—The anterior triangle is distinctly triangular in outline, with the base above.

Boundaries.—The boundaries of the anterior triangle are as follows:—

The Base.—The base is above, and is formed by the lower border of the body of the lower jaw, and by an imaginary line prolonging that backwards to the sterno-mastoid.

The Apex.—The apex is below, at the sternum.

The Anterior Boundary.—The anterior boundary is formed by the middle line of the neck. It extends from the symphysis menti to the sternum.

The Posterior Boundary.—The posterior boundary is formed by the anterior border of the sterno-mastoid.

The Floor.—On account of the irregularity of the various structures which are found in the anterior triangle, no floor is described.

The Roof.—The roof is formed, as in the posterior triangle, by the deep cervical fascia.

Subdivision of the Anterior Triangle.—The anterior triangle is subdivided into three subsidiary triangles by means of the anterior belly of the omo-hyoid muscle, and by the stylo-hyoid and digastric muscles. The three subsidiary triangles are termed respectively the muscular, carotid, and digastric triangles.

The Muscular Triangle.—The muscular triangle is so

named because its most obvious contents are the depressor muscles of the hyoid bone. It is bounded as follows:—

In front, by the middle line of the neck.

Behind, by the anterior border of the sterno-mastoid.

Above, by the anterior belly of the omo-hyoid.

The Carotid Triangle.—The carotid triangle is so called because it contains portions of all three carotid arteries. It is bounded as follows:—

Behind, by the anterior border of the sterno-mastoid.

Above, by the posterior belly of the digastric and the stylo-hyoid muscles.

Below, by the anterior belly of the omo-hyoid.

The Digastric Triangle.—The digastric triangle is so called because it is bounded by both bellies of the digastric muscle. It is bounded as follows:—

Above, by the lower jaw, and the line drawn backwards from its angle to the sterno-mastoid muscle.

Below and in front, by the anterior belly of the digastric.

Below and behind, by the posterior belly of the digastric and the stylo-hyoid muscles.

The Contents of the Muscular Triangle.—The more important contents of the muscular triangle are as follows:—

Muscles.

The depressor muscles of the hyoid bone, in part.

Nerves.

The ansa hypoglossi.

The external laryngeal nerve.

The recurrent laryngeal nerve.

Arteries.

The superior thyroid artery in part.

Other structures.

The larynx and trachea in part.

The thyroid body in part.

The œsophagus in part, on the left side only.

The Depressor Muscles of the Hyoid Bone.—The depressor muscles of the hyoid bone are four in number—the omo-hyoid, the sterno-hyoid, the sterno-thyroid, and the thyro-hyoid.

They are all supplied by the ansa hypoglossi, except

the thyro-hyoid, which is supplied by the hypoglossal nerve direct.

The Omo-Hyoid Muscle.—The omo-hyoid is a digastric muscle, which is situated on the side of the neck, and extends from the superior border of the scapula to the hyoid bone. It consists of two muscular bellies, anterior and posterior, and of an intermediate tendon.

Attachments.—The *posterior belly* is attached to the supra-scapular ligament and the adjacent part of the superior border of the scapula.

The *anterior belly* is attached to the inferior surface of the body of the hyoid bone, just external to the insertion of the sterno-hyoid muscle.

The *intermediate tendon* varies in position, but is most usually situated behind the sterno-mastoid muscle, and is bound down to the clavicle and the first rib by a process of the deep cervical fascia, which thus maintains the tendon in position.

Nerve Supply.—The ansa hypoglossi.

Action.—A simple depressor of the hyoid bone.

Relations.—The *posterior belly* of the omo-hyoid crosses the posterior triangle and divides it into an upper occipital, and a lower supra-clavicular triangle.

The *anterior belly* passes almost vertically upwards through the anterior triangle, and separates the muscular and carotid triangles. It lies immediately to the outer side of the sterno-hyoid muscle, these two muscles being on a more anterior plane than the other two muscles of the group.

The Sterno-Hyoid Muscle.—This muscle extends from the superior aperture of the thorax to the hyoid bone.

Origin.—From the posterior surface of the manubrium sterni, the posterior sterno-clavicular ligament, and from the inner end of the first costal cartilage.

Insertion.—The muscle passes upwards and inwards, to be inserted into the inferior surface of the body of the hyoid bone, just internal to the attachment of the anterior belly of the omo-hyoid muscle.

Nerve Supply.—The ansa hypoglossi.

Action.—A simple depressor of the hyoid bone.

Relations.—This muscle lies immediately to the inner side of the anterior belly of the omo-hyoid muscle, with which it is in contact for the greater part of its extent.

The Sterno-Thyroid Muscle.—This muscle lies behind the sterno-hyoid, and extends from the upper aperture of the thorax to the thyroid cartilage.

Origin.—From the posterior surface of the manubrium sterni, and from the inner end of the first costal cartilage.

Insertion.—It passes upwards and outwards, diverging from its fellow, to be inserted into the oblique line on the ala of the thyroid cartilage.

Nerve Supply.—The ansa hypoglossi.

Action.—The sterno-thyroid muscle acts indirectly upon the hyoid bone, by means of its upward continuation, the thyro-hyoid muscle. It may depress the hyoid bone, but its chief action is to depress the larynx after deglutition.

Relations.—The sterno-hyoid and sterno-thyroid muscles bound a diamond-shaped space, situated in front of the trachea, and in which the operation of tracheotomy is performed.

This space is bounded below, on either side, by the diverging sterno-thyroid muscles, and in its upper half it is bounded, on either side, by the converging sterno-hyoid muscles.

The Thyro-Hyoid Muscle.—This muscle forms the upward continuation of the sterno-thyroid muscle, from the thyroid cartilage to the hyoid bone.

Origin.—From the oblique line on the ala of the thyroid cartilage.

Insertion.—Into the outer part of the inferior surface of the body of the hyoid bone, and into its great cornu.

Nerve Supply.—A special filament from the hypoglossal nerve.

Action.—In conjunction with the sterno-thyroid muscle, it acts as a depressor of the hyoid bone.

The Ansa Hypoglossi.—The ansa hypoglossi, or the ansa cervicalis, is a nerve loop which lies in front of the common carotid artery and its sheath, just above the point where these structures are crossed by the anterior belly of the omo-hyoid muscle.

The ansa hypoglossi is formed by the junction of the *descendens hypoglossi* from the hypoglossal nerve, with the *rami communicantes hypoglossi* from the second and third cervical spinal nerves.

The concavity of the loop is turned upwards, and from its convexity branches are given off to both bellies of the omo-hyoid, the sterno-hyoid, and sterno-thyroid muscles. The anterior belly of the omo-hyoid may occasionally be supplied by a branch from the descendens hypoglossi direct.

The Subclavian Artery.—The subclavian artery commences, on the *right* side, opposite the right sterno-clavicular articulation by the bifurcation of the innominate artery into right subclavian and right common carotid arteries. A pointer passed backwards between the two heads of the sterno-mastoid muscle, just above the right sterno-clavicular articulation, would just touch the bifurcation of the innominate artery.

On the *left* side, the subclavian artery commences in the thorax, at the arch of the aorta. The left subclavian artery differs, therefore, from the right in having an intra-thoracic as well as an intra-cervical portion.

On *both* sides, the subclavian artery terminates opposite the outer border of the first rib, by becoming continuous with the axillary artery; and on both sides the subclavian artery is divided into three parts by the scalenus anticus muscle, which passes downwards in front of the second part of the artery.

The First Part of the Subclavian Artery.—This part of the vessel lies internal to the scalenus anticus muscle. It commences at the place and in the manner already indicated, and terminates at the inner border of the scalenus anticus, by becoming directly continuous with the second part of the vessel. It passes upwards and outwards, gradually diverging from the common carotid artery, and is very deeply situated.

Relations.—The *anterior* relations of the first part of the subclavian artery are numerous and important. They may be classified as follows:—

Three superficial structures.—Skin, superficial fascia and the platysma myoides muscle, and the deep fascia.

Three muscles.—The clavicular origin of the sterno-mastoid, the sterno-hyoid, and the sterno-thyroid.

Three veins.—The internal jugular descends in front of the artery. The vertebral vein also descends in front of the artery, between it and the internal jugular vein, whilst the anterior jugular crosses the artery transversely, and at a much more superficial plane, being separated from the artery by the muscles just mentioned.

Three sets of nerves.—The pneumogastric or vagus nerve crosses the artery vertically, as do also some cardiac filaments from the vagus, and filaments from the sympathetic nerve.

On the *left* side there are, in addition to the foregoing structures, three other structures in front of this part of the vessel, namely—

The left phrenic nerve.

The left innominate vein.

The thoracic duct.

Behind the artery, there are the pleura, the recurrent laryngeal nerve, and the gangliated cord of the sympathetic.

Below, the artery rests upon the pleura, and on the *right* side, upon the recurrent laryngeal nerve.

Branches of the First Part of the Subclavian Artery.

—These may be classified as follows:—

1. The vertebral.

2. The internal mammary.

3. The thyroid axis.	$\left\{ \begin{array}{l} (a) \text{ Inferior thyroid.} \\ (b) \text{ Transverse cervical} \\ (c) \text{ Suprascapular.} \end{array} \right.$	$\left\{ \begin{array}{l} \text{Superficial cervical.} \\ \text{Posterior scapular.} \end{array} \right.$

The Vertebral Artery.—This vessel, the first branch given off by the subclavian artery, arises on the *right* side, about quarter of an inch internal to the inner border of the scalenus anticus; and on the *left* side, rather nearer the middle line of the body.

It passes upwards, backwards, and outwards, between the adjacent borders of the scalenus anticus and longus colli muscles, until it reaches the vertebrarterial foramen in the transverse process of the sixth cervical vertebra. The artery enters this foramen, and runs upwards in the foramina of the

other cervical vertebræ, as far as the atlas, where it turns inwards through the suboccipital triangle, and, finally entering the skull through the foramen magnum, unites with its fellow of the opposite side, at the lower border of the pons varolii, to form the basilar artery.

The vertebral artery lies, at its commencement, behind the internal jugular and vertebral veins; it is crossed by the inferior thyroid artery, and on the left side, in addition, by the thoracic duct.

In its course through the vertebrarterial foramina, the anterior primary divisions of the cervical nerves pass out of the intervertebral foramina, behind the artery.

The *vertebral vein* emerges from the vertebrarterial foramen of the sixth cervical vertebra, and passing downwards in front of its own artery and the first part of the subclavian artery, and behind the internal jugular vein, terminates in the innominate vein of the corresponding side.

The *deep cervical* and *anterior vertebral* veins both terminate in the vertebral vein. The anterior vertebral vein is the vein which accompanies the ascending cervical artery.

The Internal Mammary Artery.—This vessel runs downwards, forwards, and inwards, behind the sternal end of the clavicle, to reach the thoracic cavity.

The Thyroid Axis.—The thyroid axis is a short, stout trunk, which arises from the subclavian, just internal to the inner border of the scalenus anticus muscle, and immediately behind the internal jugular vein. It passes forwards, and almost immediately breaks up into its three terminal branches, which are :—

The inferior thyroid.

The transverse cervical { Superficial cervical.
Posterior scapular.

Suprascapular.

The Inferior Thyroid Artery.—The inferior thyroid artery, the largest branch from the thyroid axis, passes upwards and inwards, *behind* the carotid sheath and its contents, *behind* the gangliated cord of the sympathetic, and *behind*, most usually, the recurrent laryngeal nerve, but *in front* of the vertebral artery and the longus colli muscle, to

the thyroid body, behind the lateral lobe of which it breaks up into its terminal or thyroid branches.

Branches.—The branches of the inferior thyroid are as follows :—

Muscular branches to the prevertebral muscles.

The ascending cervical artery.

The inferior laryngeal artery.

Tracheal branches.

Œsophageal branches.

Terminal or thyroid branches.

Muscular Branches.—Muscular branches are given off to the prevertebral muscles.

The Ascending Cervical Artery.—The ascending cervical artery is a small vessel which runs upwards along the inner border of the scalenus anticus muscle, between that muscle and the rectus capitis anticus major. It supplies the prevertebral muscles, and also gives off small *spinal branches*.

The Inferior Laryngeal Artery.—This small vessel runs upwards with the recurrent laryngeal nerve, in the interval between the trachea and œsophagus, to supply the back of the larynx.

Tracheal Branches.—Tracheal branches ramify upon the trachea, and anastomose below with the thoracic bronchial arteries.

Œsophageal Branches. — Œsophageal branches descend upon the œsophagus, and anastomose below with the thoracic œsophageal arteries.

Terminal or Thyroid Branches.—These are usually two in number—one passes upwards behind the lateral lobe of the thyroid body, the other supplies its base.

The Inferior Thyroid Veins.—The inferior thyroid veins do not correspond to their arteries. They commence in the lateral lobes of the thyroid body, and descend into the thorax in front of the trachea. In their downward course they are connected together by numerous cross communications, which thus form a well-marked venous plexus in front of the lower part of the trachea. This plexus constitutes a serious difficulty in the operation of low tracheotomy.

In the thorax the right inferior thyroid vein terminates

in the right innominate, just in the angle of its junction with the left innominate. The left inferior thyroid vein terminates in the thorax in the left innominate.

Tributaries.—The tributaries of the inferior thyroid veins correspond to the branches of the artery with the sole exception of the vein which accompanies the ascending cervical artery. This vein differs from the artery in both its name and termination. It is called the *anterior vertebral* vein, and it terminates in the vertebral vein.

The Transverse Cervical Artery.—This vessel runs outwards a short distance above the clavicle, and crosses the anterior surface of the scalenus anticus muscle and the nerves of the brachial plexus, until it reaches the anterior edge of the levator anguli scapulæ, where it terminates by dividing into the superficial cervical artery and the posterior scapular artery.

The Suprascapular Artery.—This artery passes outwards behind the clavicle, and crosses the anterior surface of the scalenus anticus muscle, and the third part of the subclavian artery. On reaching the upper border of the scapula it passes above the suprascapular ligament, and then turns downwards on the dorsal surface of the scapula, accompanied by the suprascapular nerve. It ramifies in the supra- and infraspinous fossæ, and anastomoses with the other scapular arteries.

The Transverse Cervical and Suprascapular Veins.—The transverse cervical and suprascapular veins differ slightly from the arteries, inasmuch as they do not cross the scalenus anticus muscle, but terminate opposite its outer border in the external jugular vein, taking part in the venous plexus which lies in front of the third part of the subclavian artery.

The Second Part of the Subclavian Artery.—This part of the vessel lies behind the scalenus anticus muscle. It extends from the inner to the outer border of that muscle.

Relations.—In front of the second part of the subclavian artery there are the integuments, the clavicular head of the sterno-mastoid muscle, the scalenus anticus muscle and the phrenic nerve. On account of the greater obliquity of the

phrenic nerve on the left side, that nerve forms an anterior relation of the *first* part of the subclavian on the left side, and not of the second part. The subclavian vein is in front of the second part of the artery, but at a slightly lower level, and is separated from the artery by the scalenus anticus muscle.

Behind and below the artery are the pleura and lung.

Branch.—The second part of the subclavian artery only gives off one branch, the superior intercostal artery.

The Superior Intercostal Artery.—The superior intercostal artery arises from the back of the second part of the subclavian artery, behind the scalenus anticus on the right side, and immediately internal to that muscle on the left side, that is, from the first part of the subclavian on the left side.

The artery first rests upon the cervical pleura, passing backwards and slightly upwards, and then, turning downwards, it enters the thoracic inlet by passing in front of the neck of the first rib, between the gangliated cord of the sympathetic internally, and the anterior primary division of the first dorsal nerve externally.

Branch.—The superior intercostal artery gives off only one branch in the neck, the *deep cervical artery*, or the *arteria profunda cervicis*. This artery, as well as its companion vein, have been described in connection with the dissection of the back.

The Thyroid Body.—The thyroid body is a very vascular structure which embraces the upper part of the trachea. It consists of two lateral lobes, united together at their lower part by an isthmus.

The Isthmus.—The isthmus of the thyroid body is inconstant in shape and position, but usually lies in front of the third and fourth rings of the trachea.

From the junction of the isthmus with either the right or left lateral lobes, but more frequently the latter, there is occasionally a thin process, the *pyramid* or the *middle lobe*, which passes upwards to the hyoid bone, to which it is often attached by a slender muscle, the *levator glandulæ thyroideæ* muscle.

The Two Lateral Lobes.—The two lateral lobes of the thyroid body are somewhat conical in shape, the apex extending as high as the middle of the body of the thyroid cartilage, and the base down to the level of the sixth ring of the trachea.

The *deep* surface of each lateral lobe is somewhat concave, and is in contact with the larynx and trachea, and with the pharynx and œsophagus.

The *superficial* surface is overlapped by the sterno-mastoid muscle, and covered by the omo-hyoid, sterno-hyoid, and sterno-thyroid muscles.

The *posterior* surface is in contact with the carotid sheath.

It is of some practical importance to remember that the thyroid body, being attached to the larynx and trachea by some fibrous tissue, will follow the movements of those structures, a point of some importance in the diagnosis of thyroid tumours, etc.

Arterial Supply.—The arterial supply of the thyroid body is derived from the two superior thyroid arteries, branches of the external carotid artery; and from the inferior thyroid arteries, from the thyroid axis.

To these is occasionally added a fifth artery, the *incon-*stant *thyroidea ima*, from the innominate artery.

Venous Return.—The veins are six in number, three on each side.

The superior and middle thyroid veins terminate in the internal jugular vein.

The inferior thyroid veins pass downwards in front of the trachea, to terminate in the thorax, in the innominate veins.

The Common Carotid Artery.—The common carotid artery commences, on the *right* side, opposite the right sterno-clavicular articulation, by the bifurcation of the innominate artery into right subclavian and right common carotid arteries.

On the *left* side, the common carotid commences in the thorax at the arch of the aorta. The left common carotid artery differs, therefore, from the right in having an intra-thoracic as well as an intra-cervical portion.

On *both* sides, the common carotid terminates opposite the upper border of the thyroid cartilage, or the fourth cervical vertebra, by dividing into internal and external carotid arteries.

The line of the common carotid artery may be indicated on the living subject by a line drawn from the sterno-clavicular articulation to a point midway between the angle of the jaw and the mastoid process. The anterior border of the sterno-mastoid muscle overlaps the artery, and forms an excellent surgical guide to the vessel.

The common carotid arteries at their commencement are only separated from each other by the trachea, but as they ascend they gradually diverge, and near their termination they are separated by the whole width of the larynx. Each common carotid is enclosed, together with the internal jugular vein and the vagus nerve, in the carotid sheath.

Relations to Muscles.—The most important muscular relations are those of the sterno-mastoid and omo-hyoid muscles.

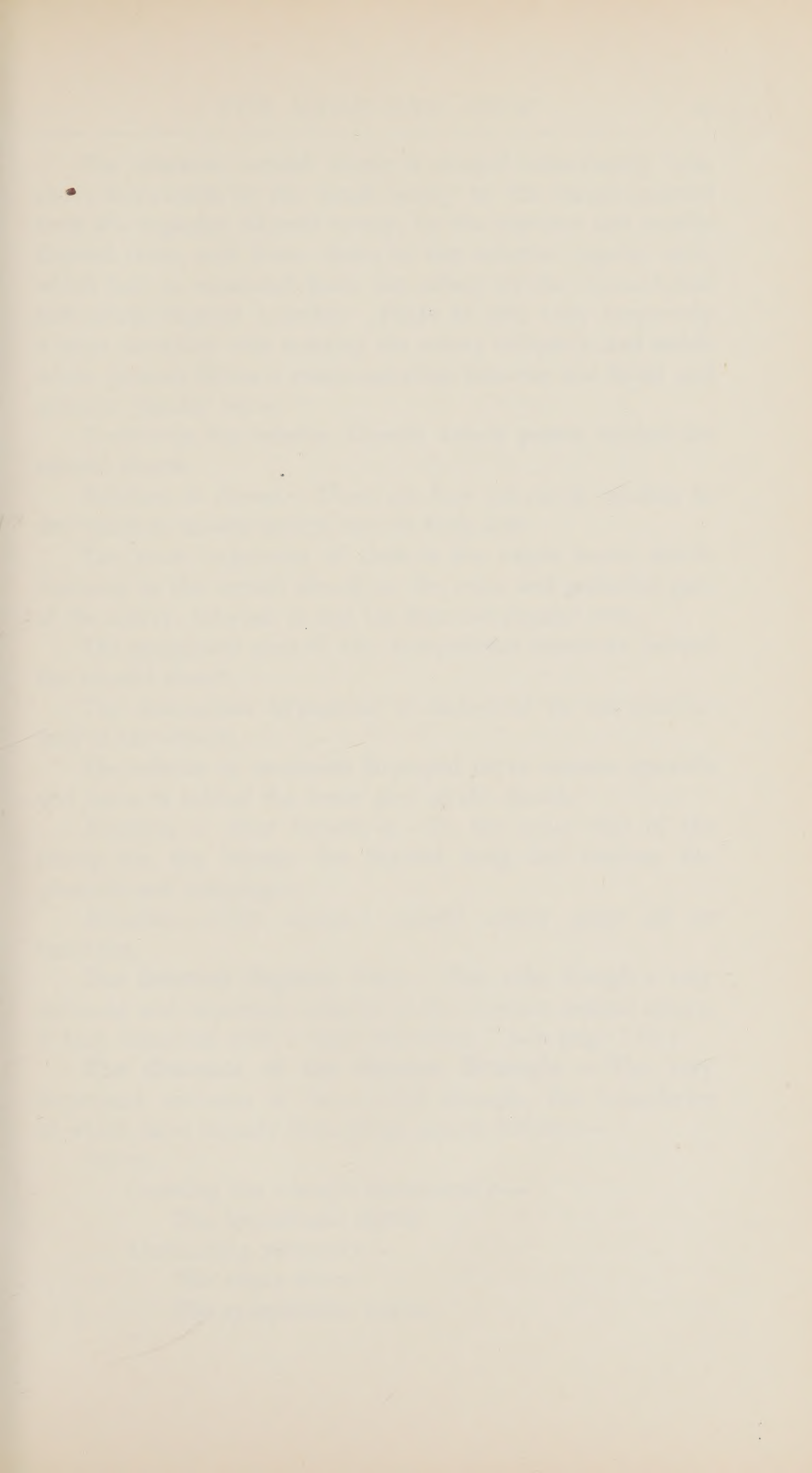
The anterior border of the sterno-mastoid muscle overlaps the artery throughout its whole extent, for it must be remembered that the carotid arteries only come to lie in the anterior triangle *after* dissection. This border of the muscle forms, therefore, an excellent surgical guide to the artery.

The anterior belly of the omo-hyoid muscle crosses the artery opposite the cricoid cartilage, or at the level of the sixth cervical vertebra.

The origins of the sterno-hyoid and sterno-thyroid muscles are in front of the vessel at its commencement.

Posteriorly, the longus colli, scalenus anticus, and rectus capitis anticus major muscles separate the artery from the transverse processes of the cervical vertebræ.

Relations to Vessels.—The most important vascular relation of the common carotid artery is that of the internal jugular vein, which lies to the outer side of the artery throughout its whole extent, the two structures being enclosed in the carotid sheath. On the right side there is a small triangular interval between the artery and the vein, in which the first part of the subclavian artery, crossed by the vagus nerve, is seen.



The common carotid artery is crossed transversely from above downwards by the small artery to the sterno-mastoid from the superior thyroid artery, by the superior and middle thyroid veins, and lower down by the anterior jugular vein, which last is separated from the artery by the sterno-hyoid and sterno-thyroid muscles. There is also very frequently a large unnamed vein crossing the artery obliquely, and which when present forms a communication between the facial and anterior jugular veins.

Posteriorly, the inferior thyroid artery passes behind the carotid sheath.

Relations to Nerves.—There are four nerves in relation to the common carotid artery, one on each side.

The most important of these is the vagus nerve, which descends in the carotid sheath on the outer and posterior part of the artery, between it and the internal jugular vein.

The gangliated cord of the sympathetic descends behind the carotid sheath.

The descendens hypoglossi is embedded in the anterior wall of the sheath.

The inferior or recurrent laryngeal nerve crosses upwards and inwards behind the lower part of the sheath.

Relations to other Structures.—To the inner side of the artery are the larynx, the thyroid body and trachea, the pharynx and œsophagus.

Branches.—The common carotid artery gives off no branches.

The Internal Jugular Vein.—This vein, though a very intimate and important relation of the common carotid artery, is best described with a later dissection. (*See page 135.*)

The Contents of the Carotid Triangle.—The very important contents of the carotid triangle, the boundaries of which have already been given, are as follows:—

Nerves.

Crossing the triangle transversely—

The hypoglossal nerve.

Descending vertically—

The vagus nerve.

The sympathetic nerve.

Crossing the triangle obliquely—

The nerve to the thyro-hyoid muscle.

The descendens hypoglossi nerve.

The internal laryngeal nerve.

The external laryngeal nerve.

The spinal accessory nerve.

Arteries.

The termination of the common carotid.

The external carotid in part, and some of its branches.

The internal carotid in part.

Veins.

The internal jugular in part, and some of its tributaries.

Other structures.

The intercarotid body.

Lymphatic vessels and glands.

The great cornu of the hyoid bone.

The larynx and pharynx in part.

The Contents of the Digastric Triangle.—The contents of the digastric triangle, most of which are dissected with the submaxillary region, are as follows:—

Nerves.

The hypoglossal.

The nerve to the mylo-hyoid.

Arteries.

The external carotid in part.

The cervical portion of the facial artery and its branches.

The posterior auricular in part.

The mylo-hyoid.

Vein.

The facial vein in part.

Glands.

The submaxillary.

The parotid in part.

Lymphatic glands.

The Elevator Muscles of the Hyoid Bone.—This group of muscles, like the antagonistic group, the depressors, con-

sists of four muscles—the digastric, the stylo-hyoid, the mylo-hyoid, and the genio-hyoid muscles.

The nerve supplies to these muscles are as follows:—

The stylo-hyoid muscle . . .	}	The trunk of the facial nerve.
The digastric muscle—		
Posterior belly		
Anterior belly	}	The nerve to the mylo-hyoid.
The mylo-hyoid muscle . . .		
The genio-hyoid muscle . . .		The hypoglossal nerve.

Of these four muscles only two are now described, as the remaining two belong to the submaxillary region.

The Stylo-Hyoid Muscle.—This is a slender muscle which extends from the styloid process to the hyoid bone, above and to the inner side of the posterior belly of the digastric.

Origin.—From the back of the styloid process near its root.

Insertion.—The muscle passes downwards and forwards, to be inserted into the hyoid bone at the junction of its body with the great cornu.

Nerve Supply.—The trunk of the facial nerve.

Action.—A simple elevator of the hyoid bone.

The Digastric Muscle.—This important muscle extends from the mastoid process to the symphysis menti, its intermediate tendon being situated at the hyoid bone.

The *posterior* belly arises from the digastric fossa of the temporal bone and passes downwards, forwards, and inwards to the intermediate tendon.

The *anterior* belly arises from the digastric fossa on the deep surface of the lower jaw near the symphysis menti. It passes downwards, backwards, and outwards to the intermediate tendon.

The *intermediate* tendon is attached to the body and great cornu of the hyoid bone by a process of deep cervical fascia.

Nerve Supply.—The *posterior* belly of the digastric is supplied by the trunk of the seventh or facial nerve.

The *anterior* belly is supplied by the nerve to the mylo-hyoid, a branch of the inferior dental nerve from the inferior maxillary division of the fifth cranial nerve.

Action.—An elevator of the hyoid bone, and, if that bone be fixed, a depressor of the lower jaw.

Relations.—The *posterior* belly of the digastric muscle and the stylo-hyoid muscle are concealed, in great part, by the parotid gland, the mastoid process, and the muscles attached thereto. They cross the carotid vessels, the internal jugular vein, and the accompanying nerves. Near the hyoid bone, the stylo-hyoid tendon splits, to permit the posterior belly of the digastric to pass through it.

The *anterior* belly of the digastric is almost entirely superficial, being only covered by the skin and superficial and deep fasciæ. It rests upon the mylo-hyoid muscle.

The Hypoglossal Nerve.—The hypoglossal, or the twelfth cranial nerve, appears in the carotid triangle at the lower border of the posterior belly of the digastric muscle, where it hooks round the occipital artery, and then turns transversely forwards under cover of the tendon of the digastric, and finally leaves the present dissection by disappearing under cover of the posterior border of the mylo-hyoid muscle.

In this part of its extent the nerve crosses the two carotid arteries and the first part of the lingual artery, and lies just above the great cornu of the hyoid bone.

Branches.—From this part of the hypoglossal nerve two branches arise—the descendens hypoglossi and the small nerve to the thyro-hyoid muscle.

The Descendens Hypoglossi.—This nerve arises from the hypoglossal, just as it is hooking round the occipital artery. It descends somewhat obliquely, embedded in the anterior wall of the carotid sheath, to just below the middle of the neck, where it is joined by the rami communicantes hypoglossi, from the second and third cervical spinal nerves, to form a loop, the ansa hypoglossi.

The ansa hypoglossi supplies three of the four depressor muscles of the hyoid bone, namely, the omo-hyoid, sterno-hyoid, and sterno-thyroid muscles.

The Small Nerve to the Thyro-Hyoid Muscle.—This nerve arises from the hypoglossal rather farther forwards than the descendens hypoglossi, and terminates in the thyro-hyoid muscle, which it supplies.

The External Carotid Artery.—This vessel commences at the upper border of the thyroid cartilage, at the level of the fourth cervical vertebra, by the bifurcation of the common carotid into external and internal carotid arteries.

It terminates in the substance of the parotid gland, opposite the neck of the lower jaw, by dividing into its two terminal branches, the superficial temporal and the internal maxillary artery.

The external carotid is at first in front of, and rather nearer the middle line, than the internal carotid, but as it passes upwards it inclines slightly backwards, and becomes more superficial than the internal carotid. It is two and a half inches in length, and is termed *external*, not on account of its relation to the internal carotid artery, but because it supplies parts outside the skull.

The course of the external carotid may be indicated on the living subject in the same way as the common carotid.

Relations.—The *superficial* relations of the external carotid artery may be conveniently divided into those below and those above the level of the posterior belly of the digastric and stylo-hyoid muscles, which structures cross the artery obliquely, along a line drawn from the mastoid process to the hyoid bone.

Below this line the artery is comparatively superficial, being covered only by the skin, superficial fascia with the platysma myoides, deep fascia, and overlapped by the anterior border of the sterno-mastoid muscle.

Above the level of this line the artery is deeply situated, being embedded in the substance of the parotid gland, which separates it from the posterior border of the ascending ramus of the lower jaw, and from the stylo-maxillary ligament.

The Deep Relations.—The deep relations of the external carotid are, from below upwards, the pharynx and hyoid bone, the glosso-pharyngeal nerve, the stylo-pharyngeus muscle, and the styloid process. The last three structures separate the external from the internal carotid artery.

Relations to Veins.—There is no companion vein to the external carotid artery, but in the substance of the parotid

gland the temporo-maxillary venous trunk lies superficial to the artery.

Below the digastric, and near its commencement, the artery is crossed transversely by the common facial and lingual veins which are passing backwards to terminate in the internal jugular vein.

Relations to Nerves.—All the nerves in relation to the external carotid artery cross it from behind forwards, three being superficial to the artery, and three deeper than the vessel.

Crossing the artery *superficially*, from above downwards, are the temporo-facial division of the seventh and the cervico-facial division of the same nerve, both these structures being above the digastric; while, lastly, the hypoglossal nerve crosses the artery below the level of the digastric muscle.

Deeper than the vessel, and in order from above downwards, are the glosso-pharyngeal, internal laryngeal, and external laryngeal nerves.

Branches.—The branches of the external carotid artery are numerous and important. They may be classified according to the order in which they arise, or more usually according to their direction, as follows:—

Passing forwards, and in order from below upwards—

The superior thyroid artery.

The lingual artery.

The facial artery.

Passing backwards, and in order from below upwards—

The inconstant artery to the sterno-mastoid muscle.

The occipital artery.

The posterior auricular artery.

Passing upwards—

The ascending pharyngeal artery.

The internal maxillary artery.

The superficial temporal artery.

The Superior Thyroid Artery.—The superior thyroid artery arises from the external carotid immediately below the great cornu of the hyoid bone. It passes forwards, and then curves downwards under cover of the omo-hyoid, sterno-hyoid, and sterno-thyroid muscles, to the apex of the lateral

lobe of the thyroid body, where it terminates by breaking up into its three terminal branches—anterior, posterior, and external.

Branches.—The branches of the superior thyroid artery are as follows:—

An infra-hyoid branch.

A sterno-mastoid branch.

The superior laryngeal artery.

The crico-thyroid artery.

Terminal or thyroid branches.

The Infra-Hyoid Artery.—This small vessel runs inwards below the hyoid bone.

The Sterno-Mastoid Branch.—This is a small vessel which crosses the common carotid artery near its termination, to supply the sterno-mastoid muscle.

The Superior Laryngeal Artery.—The superior laryngeal artery passes inwards, accompanied by the internal laryngeal nerve, under cover of the thyro-hyoid muscle, to the thyro-hyoid membrane, which it pierces in order to supply the interior of the larynx.

The Crico-Thyroid Artery.—The crico-thyroid artery runs across the crico-thyroid membrane, anastomosing with its fellow of the opposite side. This vessel, though small, is of considerable practical importance, inasmuch as it may be cut in the emergency operation of laryngotomy.

The Terminal or Thyroid Branches.—The terminal or thyroid branches arise from the main trunk of the artery close to the apex of the lateral lobe of the thyroid body. They are usually three in number—anterior, posterior, and external—and supply the thyroid body.

The Superior Thyroid Vein.—The superior thyroid vein corresponds very closely to the artery. It drains the upper part of the lateral lobe of the thyroid body, receives tributaries which correspond to the branches of the artery, and crosses the termination of the common carotid artery, to terminate in the internal jugular vein.

The Lingual Artery.—This vessel arises from the external carotid immediately above the superior thyroid artery. As only a very small part of the artery is now seen, its descrip-

tion is best deferred until the submaxillary region is reached. (See page 129.)

The Facial Artery.—The facial or the external maxillary artery arises from the external carotid just above the lingual artery. It courses through the neck on to the face, and terminates at the inner canthus of the eye, by anastomosing with the nasal branch of the ophthalmic artery. It may therefore be described as consisting of a *cervical* and a *facial* portion, only the former of which is here described.

In the *cervical* part of its extent, the facial artery rests upon the mylo-hyoid muscle. It is crossed by the posterior belly of the digastric and stylo-hyoid muscles, and is embedded in the submaxillary gland.

Branches.—The branches given off by the facial artery, whilst it is still in the neck, are as follows:—

The inferior or ascending palatine artery.

The tonsillar artery.

Submaxillary branches.

A submental branch.

The Inferior or Ascending Palatine Artery.—This vessel passes upwards between two pairs of muscles—Firstly, between the stylo-glossus and stylo-pharyngeus muscles; and, secondly, between the internal pterygoid and superior constrictor of the pharynx. At the upper border of the latter muscle it turns downwards with the levator palati muscle into the pharynx, and supplies the soft palate, tonsil, and Eustachian tube. This vessel is sometimes replaced by the ascending pharyngeal branch of the external carotid artery.

The Tonsillar Artery.—This small vessel passes upwards between the stylo-glossus and internal pterygoid muscles, and therefore on the outer side of the stylo-glossus muscle, by which it is separated from the previous vessel. At the level of the tonsil it pierces the superior constrictor of the pharynx, and supplies the tonsil. This vessel is frequently absent.

Submaxillary Branches.—These are small branches given off to the submaxillary gland, whilst the facial artery is passing through it.

The Submental Branch.—This vessel passes forwards, concealed by the lower jaw, and resting upon the mylo-hyoid muscle, to the symphysis menti, where it terminates in the supply of the various muscles found in that region.

The Facial Vein.—The *cervical* portion of the facial vein passes backwards and downwards, lying superficial to both the submaxillary gland and the facial artery. It receives tributaries corresponding to the branches of the cervical portion of the artery, and terminates by uniting with the anterior division of the temporo-maxillary venous trunk to form the *common facial vein*, which terminates in the internal jugular opposite the hyoid bone.

The Inconstant Artery to the Sterno-Mastoid Muscle.—This small vessel is more frequently represented by branches derived from the superior thyroid and occipital arteries.

The Occipital Artery.—This vessel arises from the external carotid artery opposite the facial artery, and at the lower border of the posterior belly of the digastric muscle.

It first passes upwards and backwards just below and parallel to the posterior belly of the digastric, to the interval between the transverse process of the atlas vertebra and the mastoid process; it then turns backwards, lying in the groove on the inner side of the mastoid process; and, lastly, making its appearance between the cranial attachments of the sterno-mastoid and trapezius muscles, it turns upwards on the outer side of the great occipital nerve, to the scalp, which it supplies. The artery may, therefore, be divided into three parts by the mastoid process and sterno-mastoid muscle:—

1. A first part in front of the sterno-mastoid muscle.
2. A second part internal to the sterno-mastoid muscle.
3. A third part behind the sterno-mastoid muscle.

1. *The First Part of the Occipital Artery.*—In this part of its extent the artery crosses the internal carotid artery, the pneumogastric nerve, the internal jugular vein, and the spinal accessory nerve, whilst the hypoglossal nerve crosses the occipital artery superficially, from behind forwards, near the origin of the vessel.

Branches.—The only branches which arise from the first part of the occipital artery are:—

Muscular branches, the most constant of which is the artery to the sterno-mastoid muscle.

Muscular Branches. — Muscular branches supply the various muscles which are in relation to the occipital artery. The most constant of these is the *artery to the sterno-mastoid*, which arises from the occipital close to its origin, and enters the muscle with the spinal accessory nerve.

2. *The Second Part of the Occipital Artery.*—This has already been described with the dissection of the back. (See page 20.)

3. *The Third Part of the Occipital Artery.*—This has been described with the scalp. (See page 9.)

The Posterior Auricular Artery.—This vessel arises from the external carotid artery opposite the upper border of the posterior belly of the digastric muscle. It passes upwards and backwards upon the styloid process, under cover of the parotid gland, and crossed by the facial nerve, to the groove between the cartilage of the ear and the mastoid process, where it terminates by dividing into its two terminal branches—auricular and mastoid.

Branches.—The branches of the posterior auricular artery are as follows:—

Muscular branches.

Parotid branches.

The stylo-mastoid artery.

Terminal branches.

(a) Auricular.

(b) Mastoid.

Muscular Branches.—Muscular branches are given off to the digastric and stylo-hyoid muscles.

Parotid Branches.—Small branches supply the parotid gland.

The Stylo-Mastoid Artery.—This vessel enters the stylo-mastoid foramen in company with the facial nerve, and is distributed to the middle ear and the mastoid cells. It not infrequently arises from the occipital artery.

Terminal Branches.—These have been described with the scalp. (See page 8.)

The Ascending Pharyngeal Artery.—This is the smallest branch given off by the external carotid. It arises from that vessel at, or near, the angle of its junction with the internal carotid, and passes vertically upwards between the internal carotid and the lateral wall of the pharynx.

The Intercarotic Body.—This is a very minute body which is placed upon the deep aspect of the bifurcation of the common carotid artery.

It is a small arterial gland which is closely connected with the sympathetic filaments upon the carotid vessels, and which has numerous minute arterial filaments entering it from the common and external carotid arteries. Its functions are unknown.

The Trachea.—The trachea lies in the middle line of the neck and in the superior mediastinum of the thorax.

It commences opposite the lower border of the cricoid cartilage, or opposite the sixth cervical vertebra, and, passing downwards into the superior mediastinum of the thorax, ends opposite the intervertebral disc between the fourth and fifth dorsal vertebræ, by dividing into right and left bronchi. Its length is variable, but averages about four and a half inches.

The trachea is a wide tube which is kept constantly patent by a series of some sixteen to twenty cartilaginous rings which are embedded in its walls. These rings, which are somewhat C-shaped, are deficient posteriorly, and the trachea is, in consequence, slightly flattened behind.

As the trachea descends through the neck from its origin, it gradually recedes from the surface, so that, behind the upper border of the manubrium sterni, the trachea is very deeply situated; hence low tracheotomy, where the trachea is opened below the level of the isthmus of the thyroid body, must always be a more difficult operation than high tracheotomy, where the most superficial part of the trachea—above the level of the isthmus—is opened.

The length of the cervical portion of the trachea varies

with the position of the head; when the head is thrown well back this part of the trachea is about two and three-quarter inches long; with the head in the usual position the length is only about two inches.

The Anterior Relations of the Cervical Portion of the Trachea.—The anterior relations of this part of the trachea are best classified into those which lie above the isthmus of the thyroid body (high tracheotomy), and those which lie below the isthmus of the thyroid body (low tracheotomy).

High Tracheotomy.—This operation is performed between the cricoid cartilage above, and the isthmus of the thyroid body below, that is to say, the first two rings of the trachea are opened.

The strata lying in front of this part of the trachea are:—

The skin.

The superficial fascia, with the two anterior jugular veins on either side of the middle line, and possibly, in muscular subjects, the platysma myoides muscle, in addition.

The deep cervical fascia.

The sterno-hyoid muscles may meet in the middle line in front of this part of the trachea.

The pre-tracheal process of the deep cervical fascia.

Low Tracheotomy.—This operation is performed between the isthmus of the thyroid body above, and the upper border of the manubrium sterni below, that is to say, some portions of the fifth, sixth, seventh, or eighth rings of the trachea are opened.

Low tracheotomy is a more difficult operation than high tracheotomy on account of the greater depth of the trachea from the surface, and also on account of the greater number of structures which lie superficial to it.

The strata lying in front of this part of the trachea are:—

The skin.

The superficial fascia, with the two anterior jugular veins on either side of the middle line.

The deep cervical fascia.

The supra-sternal space (*see* p. 40), containing small portions of the two anterior jugular veins, the com-

municating vein between the two, and some fat and lymphatics. The sternal heads of the sterno-mastoid muscles also lie in this space, but are not usually in front of the trachea.

The deep cervical fascia forming the posterior boundary of the supra-sternal space.

The pre-tracheal process of the deep cervical fascia.

The sterno-thyroid muscles, which diverge as they pass upwards from their origins, and assist in bounding the diamond-shaped intermuscular space (*see* p. 58) which lies in front of this part of the trachea, and in which the operation of low tracheotomy is performed.

The thymus gland in children up to the age of two years, and its remains thereafter.

The two inferior thyroid veins descend in front of this part of the trachea on either side of the middle line, and are connected together in front of the middle line by numerous cross communications.

The thyroidea ima artery in 10 per cent. of cases.

The innominate artery occasionally projects up into the neck in front of the trachea, and the left innominate vein not unusually crosses the trachea at, or just above, the upper border of the manubrium sterni.

The Posterior Relations.—Immediately behind the trachea is the œsophagus.

The Lateral Relations.—Upon either side of the trachea are the common carotid arteries, and in its upper part the deep surfaces of the lateral lobes of the thyroid body. The recurrent laryngeal nerve and the inferior laryngeal artery run upwards on either side between the trachea and the œsophagus.

The Œsophagus.—The œsophagus commences opposite the lower border of the cricoid cartilage, or opposite the sixth cervical vertebra. It passes successively through the neck, the superior mediastinum, the posterior mediastinum, and terminates in the abdomen, opposite the tenth or eleventh dorsal vertebræ, by opening into the stomach.

In the neck the œsophagus descends between the trachea and the prevertebral muscles. As it descends, it deviates slightly to the left side of the middle line; hence œsophagotomy is usually performed upon the left side.

The Lymphatic Glands of the Anterior Triangle.—The lymphatic glands in the neighbourhood of the anterior triangle of the neck are as follows:—

The deep cervical glands.

(a) Superior.

(b) Inferior.

(a) *The Superior Deep Cervical Glands.*—This series of glands accompany the internal jugular vein, and extend from the base of the skull downwards to the bifurcation of the common carotid artery.

These glands are joined by lymphatic vessels from the following parts:—

From the internal maxillary glands.

From some of the submaxillary glands.

From the cranial cavity.

From the tongue and lower part of the pharynx.

From the larynx and some of those from the thyroid body.

From the deep muscles.

Their efferent vessels terminate in the inferior deep cervical glands.

(b) *The Inferior Deep Cervical Glands.*—This series of glands lie along the lower part of the internal jugular vein and extend outwards into the supra-clavicular triangle. They establish communications with both the glands of the axilla and with the superior mediastinal glands.

These glands are joined, either directly or indirectly, by lymphatic vessels from all the other cervical glands, and hence this group of glands is one of the most important in the head and neck.

Their efferent vessels unite to form a single vessel which terminates in the right lymphatic duct, or in the thoracic duct, according to the side.

C. THE MIDDLE LINE OF THE NECK

The region known as the *middle line of the neck* comprises certain anatomical structures of the greatest surgical importance. These may be classified as follows:—

<i>Anatomy.</i>	<i>Surgery.</i>
1. The symphysis menti.	Division for cancer of the tongue.
2. Median raphè (mylohyoids).	Common position for cut throat.
3. The hyoid bone.	
4. The thyro-hyoid membrane.	Commonest position for cut throat.
5. The thyroid cartilage.	Thyrotomy.
6. The crico-thyroid membrane and crico-thyroid artery.	Laryngotomy.
7. The cricoid cartilage.	
8. The first two rings of the trachea.	High tracheotomy.
9. The isthmus of the thyroid body.	
10. The fifth, sixth, seventh, and eighth rings of the trachea, in front of which are:—	
(a) The inferior thyroid veins.	
(b) The thyroidea ima artery occasionally.	Low tracheotomy.
(c) The innominate artery occasionally.	
(d) The left innominate vein occasionally.	

1. *The Symphysis Menti.*—This is the junction of the two originally separate bilateral halves of the lower jaw.

The symphysis is sometimes divided by the surgeon for removal of the tongue in extensive carcinomatous disease, in which case the genio-hyo-glossus muscles which support the tongue and arise from the deep surface of the symphysis menti are divided, and there is consequently a risk of the tongue falling back upon the glottis and producing asphyxia.

2. *The Median Raphè between the Two Mylo-Hyoids.*—The median raphè between the two mylo-hyoid muscles forms part of their insertions.

With the head in the ordinary position this median raphè stretches horizontally backwards from the symphysis menti to the hyoid bone.

When the head is thrown well back and the chin is elevated, the median raphè passes backwards and downwards to the hyoid bone.

On either side of the median raphè there are the anterior bellies of the two digastric muscles.

3. *The Hyoid Bone.*—The position of the hyoid bone varies with the extension or otherwise of the head.

When the head is in an ordinary position the hyoid bone is on the same level as, or even a little higher than, the most dependent point of the symphysis menti.

When the head is thrown well back the hyoid descends in such a way that it comes to lie about an inch to an inch and a half below the symphysis menti; hence, in suicide by cut throat, it is most frequent to find the injury inflicted either just below the hyoid bone, or, almost as commonly, just above it.

Immediately above the hyoid bone is the supra-hyoid artery from the lingual, and immediately below it the infra-hyoid artery from the superior thyroid.

4. *The Thyro-Hyoid Membrane.*—This membrane occupies the interval between the hyoid bone and the thyroid cartilage. It is usually concealed from view by the depressor muscles of the hyoid bone, whilst laterally, it is pierced by the internal laryngeal nerve and the superior laryngeal artery.

This membrane is very frequently severed in suicide by cut throat.

5. *The Thyroid Cartilage.*—The thyroid cartilage is the

most prominent structure in the middle line of the neck; and constitutes what is popularly known as "Adam's apple."

It is almost entirely overlapped by the depressor muscles of the hyoid bone.

The anterior attachments of the true vocal cords to the deep surface of the thyroid cartilage may be indicated on the living subject by two points—one on either side of the middle line, situated, in the male, 8·5 mm. below the median notch on the upper border of the thyroid cartilage, and, in the female, 6·5 mm. below the same spot.

Division of the thyroid cartilage—*thyrotomy*—is resorted to surgically, for the extra-laryngeal removal of tumours of the vocal cords.

6. *The Crico-Thyroid Membrane*.—This membrane occupies the interval between the cricoid and thyroid cartilages.

It is partly concealed by the crico-thyroid muscles, and is crossed transversely by the arterial arch formed by the two crico-thyroid arteries.

The emergency operation of *laryngotomy* is performed in this space.

7. *The Cricoid Cartilage*.—The cricoid cartilage is placed opposite the sixth cervical vertebra. It indicates the commencement of both the trachea and the œsophagus.

8. *The First Two Rings of the Trachea*.—The very important relations of this part of the trachea, in connection with the operation of *high tracheotomy*, have been fully described on page 78.

9. *The Isthmus of the Thyroid Body*.—The isthmus of the thyroid body is inconstant in shape and position, but usually lies in front of the third and fourth rings of the trachea.

The occasional middle lobe of the thyroid, when present, passes from the isthmus upwards, in front of the various structures in this part of the middle line of the neck, to be connected to the hyoid bone by the levator glandulæ thyroideæ muscle.

The Lower Rings of the Trachea and the Associated Structures.—These have been fully described on page 78.

V. THE FACE

Definition.—By the face is understood that region which lies between the zygoma above, and the lower border of the lower jaw below.

Muscles.—The muscles of the face are those of the eyelids and eyebrow, those of the nose, and those of the lips and mouth.

The muscles of the eyelids and eyebrow—

The orbicularis palpebrarum.

The tensor tarsi.

The corrugator supercilii.

The levator palpebræ superioris.

The muscles of the nose—

The pyramidalis nasi.

The compressor naris.

The levator labii superioris alæque nasi.

The depressor alæ nasi.

The dilator naris posterior.

The dilator naris anterior.

The muscles of the mouth—

The levator labii superioris.

The levator anguli oris.

The zygomaticus major.

The zygomaticus minor.

The risorius.

The buccinator.

The depressor anguli oris.

The depressor labii inferioris.

The levator menti.

The orbicularis oris.

The above muscles are to be regarded as forming the *muscles of expression*; the nerve to be associated with this group is the seventh cranial or facial nerve.

The Muscles of the Eyelids and Eyebrows.—These muscles are four in number on each side. They are all supplied by the seventh cranial nerve, with the single exception of the levator palpebræ superioris, which is supplied by the third cranial nerve.

The four muscles are—

The orbicularis palpebrarum.

The tensor tarsi.

The corrugator supercilii.

The levator palpebræ superioris.

The Orbicularis Palpebrarum.—This is a thin, flattened sphincter muscle, which closes the opening between the eyelids. It is found not only in the eyelids, but also around the circumference of the orbit.

That part of the muscle which lies within the eyelids is termed the *palpebral* portion, and that around the orbit the *orbital* portion.

(a) *The Orbital Portion.*—Internally, the fibres are attached to the internal tarsal ligament, to the nasal process of the superior maxilla, and to the inner part of the orbital arch of the frontal bone.

Externally, the fibres pass uninterruptedly from the eyebrow to the cheek, and thus a series of concentric loops is formed around the eyelids.

(b) *The Palpebral Portion.*—This portion lies entirely within the eyelids. It is attached internally to the internal tarsal ligament, and externally to the external tarsal ligament.

Nerve Supply.—The temporal and malar branches of the facial nerve.

The Tensor Tarsi.—This is a small muscular sheet which *arises* from the lachrymal crest behind the lachrymal sac, and, passing outwards and forwards, divides into two slips, which are *inserted* into the orbicularis palpebrarum, behind the lachrymal canals.

Nerve Supply.—The facial nerve.

The Corrugator Supercilii.—This is a small muscle situated near the inner canthus of the eye, under cover of the orbicularis palpebrarum and frontalis muscles.

It *arises* from the inner part of the superciliary ridge of the frontal bone, and, passing outwards and upwards, is *inserted* into the deep surface of the skin of the eyebrow near the middle of the orbital arch.

Nerve Supply.—The temporal branches of the facial nerve.

The Levator Palpebræ Superioris.—This muscle lies within the orbit, and is there described.

The Muscles of the Nose.—Under this head are included not only the true muscles of the nose, but also the pyramidalis nasi which acts upon the forehead, and the common elevator of the upper lip and ala of the nose.

All these muscles are supplied by the facial nerve. They are as follows:—

The pyramidalis nasi.

The compressor naris.

The levator labii superioris alæque nasi.

The depressor alæ nasi.

The dilator naris posterior.

The dilator naris anterior.

The Pyramidalis Nasi.—This is a small muscle lying on the nasal bone, and which appears to be a continuation downwards of the inner part of the frontalis muscle of the scalp. It terminates below, in the aponeurosis of the compressor naris over the cartilaginous part of the nose.

Nerve Supply.—The infra-orbital branches of the facial nerve.

The Compressor Naris.—This is a small triangular muscle which is concealed at its origin by the levator labii superioris alæque nasi.

The muscle *arises* by its apex from the superior maxilla close to the anterior aperture of the nose. Passing inwards and forwards, the muscular fibres expand into a thin aponeurosis which blends with that of the opposite side in front of the nose, and with the pyramidalis nasi above. This aponeurotic tendon of insertion is intimately adherent to the skin of the nose, but is only loosely connected to the subjacent nasal cartilages by areolar tissue.

Nerve Supply.—The infra-orbital branches of the facial nerve.

The Levator Labii Superioris Alæque Nasi.—This muscle lies along the side of the nose, and extends from the inner margin of the orbit to the upper lip.

It *arises* from the nasal process of the superior maxilla,

and, passing downwards, is *inserted* into the ala of the nose and the skin of the upper lip.

Nerve Supply.—The infra-orbital branches of the facial nerve.

The Depressor Alæ Nasi.—To expose this muscle, evert the upper lip and remove the mucous membrane on each side of the frænum of the upper lip.

The muscle *arises* from the incisor fossa of the superior maxilla, and is *inserted* into the septum and posterior part of the ala of the nose.

Nerve Supply.—The infra-orbital branches of the facial nerve.

The Dilator Naris Posterior and the Dilator Naris Anterior.—These are two irregular and indistinct bundles of muscular fibres which enlarge the orifice of the nose.

The Muscles of the Mouth.—The muscles of the mouth, all of which are supplied by the facial nerve are as follows:—

The levator labii superioris	.	} Above the mouth.
The levator anguli oris .	.	
The zygomaticus major .	.	
The zygomaticus minor .	.	
The risorius . . .	.	} On either side.
The buccinator . . .	.	
The depressor anguli oris	.	} Below the mouth.
The depressor labii inferioris	.	
The levator menti .	.	
The orbicularis oris .	.	Surrounding the mouth.

The Levator Labii Superioris.—This muscle, the elevator of the upper lip, extends vertically from the lower margin of the orbit to the orbicularis oris.

It *arises* from the superior maxilla, just above the infra-orbital foramen, and from the adjacent part of the malar bone.

It passes downwards and inwards to be *inserted* into the skin of the upper lip.

Nerve Supply.—The infra-orbital branches of the facial nerve.

The Levator Anguli Oris.—This muscle is concealed at its origin by the preceding muscle.

It *arises* from the canine fossa of the superior maxilla, just below the infra-orbital foramen, and passes downwards and outwards to be *inserted* partly into the skin at the angle of the mouth, and partly into the orbicularis oris muscle in the lower lip.

Nerve Supply.—The infra-orbital branches of the facial nerve.

The Zygomaticus Major.—This muscle, as well as the zygomaticus minor, passes obliquely downwards from the malar bone to the angle of the mouth and the upper lip.

The zygomaticus major *arises* from the malar bone near the zygomatic suture, and is *inserted* into the skin near the angle of the mouth.

The Zygomaticus Minor.—This muscle *arises* from the malar bone in front of the major muscle, and is *inserted* into the upper lip in common with the levator labii superioris.

Nerve Supply.—The infra-orbital branches of the facial nerve.

The Risorius.—This small muscle *arises* from the deep fascia over the masseter muscle, and passes inwards to be *inserted* into the skin at the angle of the mouth.

Nerve Supply.—The infra-orbital branches of the facial nerve.

The Buccinator Muscle.—This is a flat, thin muscle which forms the greater part of the lateral wall of the mouth, and occupies the interval between the upper and lower jaws.

It *arises* from the outer surfaces of the alveolar margins of both the upper and lower jaws, opposite the molar teeth, and also from the pterygo-maxillary ligament.

From this origin the muscular fibres converge towards the angle of the mouth, where the intermediate muscular fibres decussate, passing into both the upper and lower lips, and blending with the fibres of the orbicularis oris.

Nerve Supply.—The short buccal branch of the facial nerve.

Action.—This muscle flattens the cheek, and keeps food between the teeth during mastication. It further expels air from the mouth, as during whistling. Both muscles acting

together will also widen the orifice of the mouth transversely.

Relations.—The *superficial* surface of this muscle is crossed by the various muscles converging on the angle of the mouth. It is also crossed at its upper part by Stenson's duct, or the duct of the parotid, which pierces the muscle opposite the second molar tooth of the upper jaw.

This surface of the muscle is covered by the *bucco-pharyngeal fascia*, or the fascia of the pharynx, which is prolonged forwards over the buccinator muscle.

The *posterior* border of the muscle arises from the pterygo-maxillary ligament, which separates the buccinator muscle from the superior constrictor muscle of the pharynx.

The *pterygo-maxillary ligament* extends from the hamular process of the internal pterygoid plate to the mylo-hyoid ridge of the lower jaw close to the last molar tooth.

The Depressor Anguli Oris.—This is a large triangular muscle, extending from the outer surface of the lower jaw to the angle of the mouth.

It *arises* by its base from the oblique line on the external surface of the lower jaw.

The muscular fibres pass upwards, and converge on the angle of the mouth, to be *inserted* partly into the skin, and partly into the orbicularis oris muscle in the upper lip.

Nerve Supply.—The supra-mandibular branches of the facial nerve.

The Depressor Labii Inferioris.—This is a quadrilateral muscle, extending from the outer surface of the lower jaw to the lower lip.

It *arises* from the outer surface of the lower jaw, from the symphysis menti as far as the mental foramen, and, passing upwards, is *inserted* into the skin of the lower lip.

Nerve Supply.—The supra-mandibular branches of the facial nerve.

The Levator Menti.—This small muscle *arises* from the incisor fossa of the lower jaw, and passes downwards to be *inserted* into the skin of the chin.

To expose the muscle, evert the lower lip, and remove the mucous membrane on either side of the frænum labii.

This muscle lies to the inner side of the depressor labii inferioris.

Nerve Supply.—The supra-mandibular branches of the facial nerve.

The Orbicularis Oris.—This is an elliptical muscle surrounding the orifice of the mouth, and mainly composed of fibres prolonged from the buccinator, and elevator and depressor muscles of the mouth. The muscle extends from the nose, to the groove which separates the lower lip from the chin.

Nerve Supply.—The infra-orbital, short buccal, and supra-mandibular branches of the facial nerve.

The Motor Nerve of the Face.—The seventh cranial or facial nerve is the great motor nerve for the face. In addition to this, the *temporal* branches of the facial nerve form the motor nerves for the anterior half of the scalp, and its *posterior auricular* branch is the motor nerve for the posterior half of the scalp, whilst the *infra-mandibular* branch strays on to the neck and supplies the platysma myoides muscle.

The trunk of the facial nerve emerges at the stylo-mastoid foramen, passes downwards for a short distance and then turns forwards through the substance of the parotid gland until it reaches the posterior border of the ascending ramus of the lower jaw, immediately behind which it divides into an upper or *temporo-facial* division, and a lower or *cervico-facial* division, this division taking place in the substance of the parotid gland.

The Temporo-Facial Division of the Facial Nerve.—This passes forwards from its origin, through the substance of the parotid gland, and there crosses superficially, and from behind forwards, the temporo-maxillary venous trunk and the external carotid artery.

Whilst lying in the substance of the parotid gland the temporo-facial division of the facial communicates with the auriculo-temporal nerve (from the inferior maxillary division of the fifth cranial nerve), and also with the cervico-facial division of the facial, forming with the latter a well-marked plexus which is termed the *pes anserinus*.

The Cervico-Facial Division of the Facial Nerve.—

This nerve is rather smaller than the temporo-facial division. It passes from its origin, forwards, and slightly downwards, through the parotid gland, in the substance of which it breaks up into its three branches.

Whilst lying in the substance of the parotid gland the cervico-facial division communicates with the great auricular nerve, and also with the temporo-facial division of the facial nerve by means of the pes anserinus.

Branches of the Trunk of the Facial Nerve and of its Two Divisions.—The trunk of the facial nerve gives off three branches outside the skull, as do also its two divisions. These are as follows:—

From the trunk of the facial nerve—

The posterior auricular nerve.

The nerve to the posterior belly of the digastric muscle.

The nerve to the stylo-hyoid muscle.

From the upper or temporo-facial division—

The temporal branches.

The malar branches.

The infra-orbital branches.

From the lower or cervico-facial division—

The short buccal nerve.

The supra-mandibular nerve.

The infra-mandibular nerve.

Branches from the Trunk of the Facial Nerve.—These are three in number, as follows:—

The Posterior Auricular Nerve.—This nerve constitutes the motor nerve for the posterior half of the scalp. It arises from the trunk of the facial nerve close to the stylo-mastoid foramen. Its subsequent course has been described on page 7.

The Nerve to the Posterior Belly of the Digastric Muscle.—This nerve arises from the trunk of the facial just below the posterior auricular nerve. It supplies the posterior belly of the digastric muscle, and sometimes communicates with the glosso-pharyngeal nerve.

The Nerve to the Stylo-Hyoid Muscle.—This arises in

common with the preceding nerve, and supplies the stylohyoid muscle on its posterior aspect.

Branches from the Upper or Temporo-Facial Division.

—These are three in number, as follows:—

The Temporal Branches.—The temporal branches, three or four in number, constitute the motor set of nerves for the anterior half of the scalp. They ascend obliquely, and, crossing the zygoma superficially, supply the various muscles mentioned on page 7.

The Malar Branches.—These branches pass forwards to the malar bone on the outer wall of the orbit. They supply the orbicularis palpebrarum muscle, and communicate with the malar branch from the superior maxillary division of the fifth nerve.

The Infra-Orbital Branches.—The infra-orbital branches, of larger size than the other facial branches, pass almost horizontally forwards to supply the various muscles between the orbit and the mouth. At the infra-orbital foramen they communicate very freely with the infra-orbital branches from the superior maxillary division of the fifth nerve.

Branches from the Lower or Cervico-Facial Division.

—These are three in number, as follows:—

The Short Buccal Nerve.—This nerve crosses the buccinator muscle to the angle of the mouth. It supplies the orbicularis oris and buccinator muscles, and communicates with the long buccal nerve from the inferior maxillary division of the fifth nerve.

The Supra-Mandibular Nerve.—This nerve passes forwards, under cover of the depressor anguli oris and upon the lower jaw, to supply the muscles of the lower lip, and to communicate with the mental branch from the inferior maxillary division of the fifth nerve.

The Infra-Mandibular Nerve.—This nerve lies below the lower jaw, and therefore in the neck. Piercing the deep fascia, its branches form a series of arches under cover of the platysma myoides muscle, in which structure they end, after communicating with the superficial cervical nerve from the cervical plexus.

The Second or Facial Part of the Facial Artery.—

The first or cervical portion of this artery has been described on page 74.

The facial artery enters the region of the face by crossing the body of the lower jaw immediately in front of the masseter muscle. It passes upwards with a very tortuous course towards the inner canthus of the eye, *resting* successively upon the lower jaw, the buccinator muscle, the levator anguli oris and levator labii superioris muscles.

In this part of its extent it is *covered* by the skin and platysma myoides muscle, the risorius and zygomaticus major muscles.

The facial vein lies behind the artery, and some branches of the facial nerve cross the artery superficially, the infra-orbital branches of that nerve being, however, more deeply situated than the artery.

Branches.—The branches of the second or facial portion of the facial artery are as follows:—

The inferior labial artery.

The inferior coronary artery.

The superior coronary artery.

The lateral nasal artery.

The angular artery.

The Inferior Labial Artery.—This vessel passes forwards under cover of the depressor anguli oris, to supply the skin and muscles of the lower lip.

The Inferior Coronary Artery.—This vessel arises at the outer border of the depressor anguli oris, and passes forwards under cover of that muscle, and between the orbicularis oris and the mucous membrane of the lower lip, to supply the lower lip.

The Superior Coronary Artery.—This artery arises under cover of the zygomaticus major muscle, and runs forwards in the upper lip, being situated, like the inferior coronary artery, between the orbicularis oris and the mucous membrane. This vessel gives off a *septal* branch to the septum nasi.

The Lateral Nasal Artery.—This artery runs inwards to the side of the nose, and is sometimes represented by several branches.

The Angular Artery.—The angular artery, or the terminal branch of the facial artery, anastomoses, at the inner

canthus of the eye, with the nasal branch of the ophthalmic, a branch of the internal carotid artery. This anastomosis is consequently an important one, as it is in reality one between the internal and external carotid arteries.

The Superficial Temporal Artery.—This vessel is one of the two terminal branches of the external carotid.

It commences opposite the neck of the lower jaw, in the substance of the parotid gland, by the bifurcation of the external carotid into superficial temporal and internal maxillary arteries.

From this origin the superficial temporal artery passes upwards in the substance of the parotid gland, in the interval between the external auditory meatus and the condyle of the lower jaw, as far as the zygoma, where it emerges from the parotid, and, crossing the zygoma superficially, passes on to the scalp, where it becomes subcutaneous, and terminates by dividing into anterior and posterior superficial temporal arteries.

Branches.—The branches of the superficial temporal artery are as follows:—

Parotid branches.

Anterior auricular branches.

The transverse facial artery.

The middle temporal artery.

The orbital artery.

Terminal branches.

(a) Anterior superficial temporal.

(b) Posterior superficial temporal.

Parotid Branches.—Very small offsets are given off to the parotid gland.

Anterior Auricular Branches.—Two small auricular branches, superior and inferior, are given off to the pinna and the external auditory meatus.

The Transverse Facial Artery.—This vessel arises from the main trunk in the substance of the parotid gland. It passes horizontally forwards immediately above Stenson's duct, resting upon the masseter muscle, and accompanied by the infra-orbital branches of the facial nerve.

It supplies the parotid gland and the skin of the face.

The Middle Temporal Artery.—This vessel arises just above the zygoma, and, piercing the temporal fascia and the temporal muscle, ascends in a slight groove on the squamous temporal. It supplies the temporal muscle.

The Orbital Artery.—This small vessel runs forwards immediately above the zygoma and between the two layers of the temporal fascia, to supply the orbicularis palpebrarum muscle and the skin.

Terminal Branches.—These have been described with the scalp. (See page 8.)

The Common Temporal Vein.—This vein is formed on the scalp, just above the zygoma, by the union of the superficial temporal and middle temporal veins.

The *superficial temporal* vein is the vein accompanying the posterior superficial temporal artery.

The *middle temporal* vein commences in a venous plexus situated in the temporal fossa, and pierces the temporal fascia to unite with the superficial temporal, just above the zygoma, to form the common temporal vein.

The *common temporal* vein, having been so formed, descends superficially to the zygoma, and in the substance of the parotid gland as far as the neck of the lower jaw, where it terminates by uniting with the internal maxillary vein to form the *temporo-maxillary* venous trunk.

Tributaries.—The tributaries of the common temporal vein are the superficial and middle temporal veins which form it, the anterior auricular veins, parotid veins, and the transverse facial vein.

The Temporo-Maxillary Venous Trunk.—This important vein is formed in the substance of the parotid gland, opposite the neck of the lower jaw, by the union of the common temporal and internal maxillary veins. It descends in the substance of the parotid gland, lying between the facial nerve which is superficial to it, and the external carotid artery which is deeper than the vein, as far as the angle of the lower jaw, where it terminates by dividing into two divisions, anterior and posterior.

The *anterior* division of the temporo-maxillary venous trunk passes forwards and downwards, either superficial to or

deeper than the posterior belly of the digastric and stylohyoid muscles, to unite with the facial vein to form the *common facial* vein, which opens into the internal jugular vein opposite the great cornu of the hyoid bone.

The *posterior* division of the temporo-maxillary venous trunk passes backwards across the anterior border of the sterno-mastoid muscle, to unite just behind the angle of the lower jaw, with the posterior auricular vein, to form the *external jugular* vein. (See page 36.)

The Facial Vein.—This vein commences at the inner canthus of the eye, as a direct continuation of the *angular* vein, which collects venous blood from the forehead. The facial vein passes downwards behind, and with a straighter course than the artery, to terminate just below the level of the posterior belly of the digastric muscle, by uniting with the anterior division of the temporo-maxillary venous trunk, to form the *common facial* vein.

Tributaries.—The tributaries of the facial vein correspond to the branches of the facial artery, with, in addition, the *deep facial* or the *anterior maxillary* vein.

The *angular* vein, as a direct continuation of which the facial vein commences, is formed at the inner canthus of the eye, by the union of the *frontal* and *supra-orbital* veins.

The *deep facial* or *anterior maxillary* vein is a large vessel which passes forwards from the pterygoid venous plexus, over the zygomatic surface of the superior maxilla, to open into the facial vein just below the malar bone.

The Parotid Gland.—The parotid gland is the largest of the three salivary glands. The three salivary glands, with their ducts, are as follows:—

The parotid gland with Stenson's duct.

The submaxillary gland with Wharton's duct.

The sublingual gland with the ducts of Rivinus.

The parotid gland occupies the interval between the ear and the lower jaw, and extends inwards almost as far as the pharynx. Its shape is somewhat irregular, but it may be described as presenting for examination four surfaces—external, anterior, posterior, and internal or deep.

The External Surface.—This surface corresponds to the

skin, from which it is separated by superficial and deep fascia only. It is convex and lobulated, and is bounded *above*, by the zygoma; *below*, by an imaginary line drawn backwards from the lower border of the body of the lower jaw to the sterno-mastoid muscle; *behind*, by the mastoid process, the pinna, and the sterno-mastoid muscle.

The *anterior* border of this surface is irregular, and is prolonged forwards on to the masseter muscle. From this border the duct of the parotid passes forwards.

The Anterior Surface.—This surface is in contact with the masseter muscle, with the posterior border of the ascending ramus of the lower jaw, and with the internal pterygoid muscle. At this situation, the parotid extends forwards for a short distance between the external and internal pterygoid muscles.

The Posterior Surface.—The posterior surface of the parotid is in contact with the sterno-mastoid and the posterior belly of the digastric.

The Internal or Deep Surface.—This surface of the gland is very deeply situated, and is in contact with the styloid process and the three muscles which arise from it; it is also closely related to the internal jugular vein and the internal carotid artery, the vagus, spinal accessory, and hypoglossal nerves.

A small portion of the parotid projects up into, and occupies the posterior or tympanic part of the glenoid fossa, and is hence sometimes termed the *glenoid lobe*.

Structures embedded within the Parotid Gland.—Embedded within the substance of the gland are some most important structures.

The most superficial of these is the facial nerve, which breaks up in the substance of the gland into temporo-facial and cervico-facial divisions, which pass more or less horizontally through the gland substance. Entering the lower part of the gland are some branches from the great auricular nerve.

The various veins found in the substance of the parotid occupy an intermediate plane between the nerves and the arteries. The veins found in the substance of the parotid are the common temporal, and its tributary the transverse facial

vein; the commencement of the temporo-maxillary venous trunk; and the termination of the internal maxillary vein, which is passing backwards to unite with the common temporal to form the temporo-maxillary venous trunk.

Deepest of all are the arteries. These are, the termination of the external carotid artery, dividing into its two terminal branches—superficial temporal and internal maxillary arteries; and the transverse facial, a branch of the superficial temporal artery.

The Duct of the Parotid, or Stenson's Duct.—The duct of the parotid emerges at its anterior border, and passes forwards about a finger's breadth below the zygoma, across the masseter muscle. At the anterior border of the masseter the duct turns inwards towards the cheek, and, piercing the buccinator muscle and the mucous membrane of the mouth, terminates opposite the second molar tooth of the upper jaw.

Stenson's duct is about two and a half inches in length, and its position may be indicated, on the living subject, by a line drawn from the lobule of the ear, to a point midway between the red margin of the lip and the ala of the nose. If this line be bisected, the posterior half of the line will accurately represent the position of the duct, and the point of bisection the point at which the duct terminates in the mouth.

Stenson's duct is frequently accompanied by a small detached portion of the parotid gland, termed the *socia parotidis*, which rests upon the masseter muscle. In its course the duct passes forwards between the transverse facial artery which lies above it, and some branches of the facial nerve which lie below it.

The Masseter Muscle.—This muscle, though found in the face, belongs to the muscles of mastication, and is described with the next region, the pterygo-maxillary region.

The Sensory Nerves of the Face.—The sensory nerves of the face, some of which have been already described, are derived from all three divisions of the fifth cranial nerve, as follows :—

From the first or ophthalmic division—

The supra-orbital nerve.

The supra-trochlear nerve.

The nasal nerve.

The palpebral branch from the lachrymal nerve.

The infra-trochlear branch of the nasal nerve.

From the second or superior maxillary division—

The infra-orbital nerve.

The temporal branch of the orbital nerve.

The malar branch of the orbital nerve.

From the third or inferior maxillary division—

The long buccal nerve.

The mental nerve.

The auriculo-temporal nerve.

Branches from the First or Ophthalmic Division of the Fifth Cranial Nerve.—The branches from the first or ophthalmic division of the fifth cranial nerve which supply the skin of the face and scalp are five in number, as follows:—

The supra-orbital nerve.

The supra-trochlear nerve.

The nasal nerve.

The palpebral branch from the lachrymal nerve.

The infra-trochlear branch of the nasal nerve.

The Supra-Orbital Nerve.—This nerve passes on to the scalp, and is there described. (*See page 6.*)

The Supra-Trochlear Nerve.—This nerve also passes on to the scalp, and is there described. (*See page 6.*)

The Nasal Nerve.—This nerve appears on the face between the nasal bone and the lateral nasal cartilage, and supplies the skin over the lower part of the nose.

The Palpebral Branch from the Lachrymal Nerve.—This branch appears in the upper eyelid above the outer canthus, and, piercing the superior palpebral ligament, supplies the skin of the upper eyelid, and that over the external angular process.

The Infra-Trochlear Nerve.—This nerve arises from the nasal nerve, whilst that nerve is still within the orbital cavity. It appears on the face just below the trochlea of the superior oblique muscle of the eyeball, near the inner canthus. It supplies the skin of the upper eyelid, and the root of the nose.

Branches from the Second or Superior Maxillary Division of the Fifth Cranial Nerve.—These branches are three in number, as follows:—

The infra-orbital nerve.

The temporal branch of the orbital nerve.

The malar branch of the orbital nerve.

The Infra-Orbital Nerve.—This nerve, which is the termination of the superior maxillary division of the fifth cranial nerve, appears on the face at the infra-orbital foramen, under cover of the levator labii superioris muscle, where it breaks up into its terminal branches for the supply of the skin of the side of the nose, lower eyelid, and upper lip. It communicates very freely with the infra-orbital branches of the seventh nerve.

The Temporal Branch of the Orbital Nerve.—This nerve has been described on page 6.

The Malar Branch of the Orbital Nerve.—This nerve lies at first in the lower angle of the orbit, and reaches the face through the malar foramen. It supplies the skin over the malar bone, and communicates with the malar branches of the facial nerve.

Branches from the Third or Inferior Maxillary Division of the Fifth Cranial Nerve.—These branches are three in number, as follows:—

The long buccal nerve.

The mental nerve.

The auriculo-temporal nerve.

The Long Buccal Nerve.—The long buccal nerve makes its appearance at the anterior border of the masseter muscle. It supplies the skin of the cheek, and also gives off a branch which pierces the buccinator muscle to supply the mucous membrane.

The Mental Nerve.—This nerve is one of the two terminal branches of the inferior dental nerve from the inferior maxillary division of the fifth. It appears on the face at the mental foramen in the lower jaw, under cover of the depressor anguli oris. This nerve supplies the skin of the lower lip and chin, and the mucous membrane of the lower lip, and communicates with the supra-mandibular branch of the facial nerve.

The Auriculo-Temporal Nerve.—This nerve passes to the scalp, and is there described. (See page 6.)

In connection with the sensory nerves of the face, it should be remembered that they are of some considerable practical importance in connection with facial neuralgia.

The supra-orbital, the infra-orbital, and mental nerves may respectively be regarded as representing, on the face, the terminations of the ophthalmic, superior maxillary, and inferior maxillary divisions of the fifth cranial nerve.

A line drawn through the supra-orbital notch to the interval between the two bicuspid teeth of the lower jaw will pass through these three nerves. Further, the fifth and seventh cranial nerves communicate on the face, forming a series of plexuses between a sensory and a motor nerve, thus explaining the occurrence of motor spasms in severe facial neuralgia.

The External Ear.—The external ear consists of two parts:—

(a) The auricle or pinna.

(b) The external auditory meatus.

A. The Auricle or Pinna.—The pinna is somewhat ovoid in shape, with the larger end uppermost. It possesses a recurved margin, and is fixed internally to the margin of the external auditory meatus.

The External Anatomy of the Pinna.—As regards its external anatomy, the pinna may be described as presenting for examination:—

1. An internal or cranial surface.
2. An external surface.
3. A margin.
4. A lobule.

1. *The Internal or Cranial Surface.*—This surface, which is generally convex, lies nearest the skull.

2. *The External Surface.*—This surface is very irregular, and is marked by certain elevations and depressions.

The *concha* is the deep central hollow or recess which leads into the external auditory meatus. It is wider above than below.

The *tragus* is the triangular projection which lies imme-

diately in front of the narrow lower part of the concha. The deep surface of the tragus is usually covered by some small hairs.

The *anti-tragus* is the small projection which lies immediately behind the narrow lower part of the concha.

The *incisura inter-tragica* is the name sometimes given to that portion of the concha which lies between the tragus and the anti-tragus.

3. *The Margin*.—The prominent rim-like margin of the ear is termed the *helix*. This commences in the centre of the concha in an elevation termed the *crus helicis*; the helix then sweeps round the upper and posterior parts of the ear, to terminate in the lobule.

On the anterior edge of the helix, at its upper and posterior part, there is very frequently a small pointed nodule, termed *Darwin's tubercle*. This is the equivalent in man of the much more distinctly pointed extremity met with in the expanded ears of quadrupeds.

The *anti-helix* is a second curved ridge situated within the helix. It commences, below, at the anti-tragus, and sweeps round the cavity of the concha, to terminate above, by dividing into two ridges, which are termed respectively the *crus anti-helicis superior* and the *crus anti-helicis inferior*.

The *fossa scaphoidea*, or the *fossa of the helix*, is the slight, shallow, curved groove which lies between the helix and the anti-helix.

The *fossa triangularis*, or the *fossa of the anti-helix*, is the triangular depression which lies between the two diverging terminal limbs of the anti-helix.

4. *The Lobule*.—The lobule is the soft, pendulous part in which the pinna terminates inferiorly. The lobule is usually regarded as a human characteristic, but it is occasionally well marked in anthropoid apes, and is sometimes but poorly developed in man.

Structure of the Pinna.—The pinna is composed of an irregular portion of yellow fibro-cartilage, with certain unimportant intrinsic muscles and ligaments, and a small amount of adipose tissue, the whole being covered by skin.

These structures are not sufficiently important to war-

rant their detailed description. It will suffice to give their enumeration as follows:—

Cartilage.

Yellow fibro-cartilage.

Muscles.

Musculus helcis major.	}	External surface.
Musculus helcis minor.		
Musculus tragicus . . .		
Musculus anti-tragicus .		
Musculus transversus auriculæ	}	Internal surface.
Musculus obliquus auriculæ .		

Ligaments.

The anterior ligament.

The posterior ligament.

B. The External Auditory Meatus.—This is described in the volume dealing with the special senses.

The Appendages of the Eye.—The appendages of the eye include the following parts:—

The eyebrow.

The eyelids.

The lachrymal apparatus.

The Eyebrow.—The eyebrow is the curved eminence which is situated just above the eye, and which lies immediately in front of the supra-orbital margin of the frontal bone.

The prominence of the eyebrow is produced partly by a thickening of the integuments, and partly by the subjacent orbicularis palpebrarum and corrugator supercilii muscles.

The Eyelids.—The eyelids are two in number on each side—upper and lower.

The *upper* eyelid is the larger and more freely movable of the two. It is provided with a special elevator muscle—the levator palpebræ superioris.

The interval between the two eyelids is termed the *palpebral* fissure, and at each end the eyelids are united together by a species of commissure which is termed the *canthus*.

In the region of the inner canthus, there is, upon the free edge of each eyelid, a minute elevation termed the

papilla lachrymalis; on the apex of this papilla is the extremely minute orifice of the *punctum lachrymale*, which is the external opening of the canal, one for each eyelid, which removes the lachrymal fluid which has passed across the conjunctiva from the lachrymal gland.

Structure of the Eyelids.—Each eyelid consists principally of a fibrous plate—the *tarsus*—attached to the bone by the palpebral and tarsal ligaments.

In each eyelid there are the following strata in order from before backwards:—

Upper Eyelid.

1. The skin.
2. The palpebral portion of the orbicularis palpebrarum muscle.
3. The tarsus, the superior palpebral ligament, and the tendon of insertion of the levator palpebræ superioris.
4. The conjunctiva.

Lower Eyelid.

1. The skin.
2. The palpebral portion of the orbicularis palpebrarum muscle.
3. The tarsus, and the inferior palpebral ligament.
4. The conjunctiva.

In addition to the foregoing structures there are the internal and external tarsal ligaments, which attach the tarsi to the inner and outer margins of the orbit respectively.

The Palpebral Portion of the Orbicularis Palpebrarum Muscle.—This portion of the orbicularis palpebrarum muscle lies entirely within the eyelids. Along the palpebral edge of each eyelid the muscle is somewhat thickened, forming what is known as the *musculus ciliaris*.

The Superior Tarsus.—The superior tarsus is an elongated, crescentic plate of dense connective tissue, containing no cartilage cells. It is rather larger than the inferior tarsus.

The *superior* border of the upper tarsus is convex and thin; inserted into it is the middle slip of insertion of the levator palpebræ superioris.

The *inferior* border is thick and straight, and is intimately adherent to the skin.

The *anterior* surface lies immediately behind the palpebral portion of the orbicularis palpebrarum muscle.

The *posterior* surface is lined by the conjunctiva.

The *internal* border is fixed to the nasal process of the superior maxilla by the internal tarsal ligament.

The *external* border is fixed to the malar bone by the external tarsal ligament.

The Inferior Tarsus.—The inferior tarsus, much smaller than the superior, is a narrow band with almost straight edges. Its attachments and relations closely coincide with those of the superior tarsus.

The Superior Palpebral Ligament.—The superior palpebral ligament is attached *above* to the pericranium along the supra-orbital margin of the frontal bone.

Below, it becomes continuous with the anterior slip of insertion of the levator palpebræ superioris.

The Inferior Palpebral Ligament.—The inferior palpebral ligament is attached *below* to the periosteum of the face and to the floor of the orbit.

Above, it is attached to the lower border of the inferior tarsus.

The two palpebral ligaments form, together, a species of incomplete orbital diaphragm, which is sometimes termed the *septum orbitale*.

The Meibomian Follicles.—The Meibomian follicles, or the tarsal glands, are embedded in the tarsus. They form a series of parallel glands, placed on the deep surface of each tarsus, at right angles to its free or palpebral border. They number about thirty in the upper eyelid, and about twenty in the lower.

The ducts of the Meibomian follicles open in a line along the free margin of each eyelid immediately behind the eyelashes.

The Conjunctiva.—The deep surface of each eyelid is lined by conjunctiva. Above, or below each eyelid respectively, the palpebral conjunctiva becomes continuous with the ocular conjunctiva, the line of reflection between the two being termed the *fornix conjunctivæ*.

The Internal Tarsal Ligament.—The internal tarsal ligament is a small fibrous band situated at the inner side of the orbit. It serves to fix the two tarsal plates internally, and also gives origin to the orbicularis palpebrarum muscle.

Internally, the internal tarsal ligament is attached to the nasal process of the superior maxilla just in front of the

lachrymal groove. It passes outwards immediately in front of the lachrymal sac.

Externally, it divides into two parts, which are attached to the inner borders of the superior and inferior tarsi respectively.

The External Tarsal Ligament.—The external tarsal ligament is an unimportant band which connects the two tarsi to the malar bone.

The Lachrymal Apparatus.—This is best described with the orbit. (*See page 174.*)

The Cartilages of the Nose.—The cartilages of the nose are five in number, as follows:—

One unpaired and central—

The septal cartilage.

Two paired and lateral—

The two lateral cartilages.

The two cartilages of the aperture.

The Septal Cartilage.—This is described with the dissection of the nasal fossæ. (*See page 201.*)

The Two Lateral Cartilages.—Each lateral cartilage is flattened and triangular in shape.

The *posterior* border of each lateral cartilage is attached to the nasal bone and superior maxilla.

The *anterior* or mesial border is attached, in the greater part of its extent, to its fellow of the opposite side. At the lower part of this border the two lateral cartilages do not quite meet in the middle line, consequently a slight interval is formed, in which is seen a small part of the central septal cartilage. The deep surface of this border, in the greater part of its extent, rests upon the central septal cartilage.

The *inferior* border or base of each lateral cartilage is connected with the cartilage of the aperture by some dense fibrous tissue.

The Two Cartilages of the Aperture.—Each cartilage of the aperture forms an incomplete ring around the margins of the anterior nares. This ring is deficient posteriorly.

That part of the cartilage of the aperture which bounds the orifice of the nose *externally*, is narrow and pointed posteriorly, and becomes broken up into several subsidiary

parts, which are termed the *cartilagine quadratae*, or the *sesamoid cartilages*.

That part of the cartilage of the aperture which bounds the orifice of the nose *internally*, is short and narrow. It lies in the columna nasi immediately below the anterior end of the septal cartilage, and projects backwards almost to the superior maxilla.

In front, each cartilage of the aperture comes into contact with its fellow of the opposite side and swells out somewhat to form the apex of the nose.

VI. THE DEEP TEMPORAL AND PTERYGO-MAXILLARY REGIONS

Definition.—The pterygo-maxillary region may be defined as being the region which lies on the internal or deep surface of the ascending ramus of the lower jaw, and in which the muscles of mastication form, in part, the chief structures.

The Muscles of Mastication.—The muscles of mastication are four in number—the masseter, the temporal, the external, and the internal pterygoids.

All the muscles of mastication are supplied by the inferior maxillary division of the fifth cranial nerve.

The Masseter Muscle.—This powerful muscle is quadrilateral in outline, and is situated on the outer surface of the ascending ramus of the lower jaw.

Origin.—The masseter arises by two heads—a superficial and a deep head.

The *superficial* head arises from the anterior two-thirds of the lower border of the zygoma.

The *deep* head arises from the whole length of the deep surface of the zygoma, and from the posterior third of its lower border.

Insertion.—The fibres from the *superficial* head pass downwards and backwards, those from the *deep* head downwards and slightly forwards, to be inserted into the lower half of the external surface of the ascending ramus of the lower jaw.

Nerve Supply.—The nerve to the masseter, from the

anterior division of the inferior maxillary division of the fifth cranial nerve.

Action.—A powerful elevator of the lower jaw.

Relations.—The greater part of the *external* surface of the masseter muscle is subcutaneous, but posteriorly it is overlapped by the parotid gland, and the duct of the parotid crosses it, as do also some branches from the facial nerve and the transverse facial vessels.

The *deep* surface is in contact with the ascending ramus of the lower jaw and with its sigmoid notch. The nerve to the masseter, accompanied by the masseteric artery, passes through the sigmoid notch to supply the muscle on its deep surface.

The *anterior* border of the masseter is free, and overlaps the buccinator muscle. In the interval between this border of the masseter and the buccinator there is a mass of fat, termed the buccal pad of fat. It is especially well developed in the infant, and is therefore termed the sucking-pad.

The Temporal Fascia.—The temporal fascia, from which the temporal muscle takes origin, is a dense, shining membrane, which covers the temporal muscle above the level of the zygoma.

It is attached *above*, to the temporal crest of the frontal bone, and to the lower of the two temporal ridges on the outer surface of the parietal bone.

Below, the fascia splits as it descends, and the two layers are attached to the outer and inner surfaces respectively of the zygoma.

Dissection.—The zygoma must now be sawn through, both in front of and behind the attachment of the masseter, and then the masseter may be thrown down along with the periosteum of the lower jaw. In doing this, the nerve and artery to the masseter passing to the muscle through the sigmoid notch of the lower jaw will be cut through. This dissection is necessary, in order to expose the temporal muscle at its insertion, and as a preliminary to the subsequent dissection and study of the region.

The Temporal Muscle.—The temporal muscle is a large

fan-shaped muscle occupying the temporal fossa, and having its base above and behind, and its apex at the coronoid process of the lower jaw.

Origin.—The temporal muscle arises from the temporal fossa, and from the temporal fascia covering the muscle.

The five bones forming the temporal fossa are the frontal, the great wing of the sphenoid, parietal, temporal, and malar bones.

Insertion.—From the foregoing origin the muscular fibres converge on the coronoid process of the lower jaw, in such a way that the anterior fibres descend vertically, the intermediate fibres obliquely, and the posterior fibres pass almost horizontally forwards, to be inserted as follows:—

Into the posterior border of the coronoid process, into the anterior border of the same process, into the anterior border of the ascending ramus of the lower jaw, and into the deep surface of the coronoid process.

Nerve Supply.—The anterior, middle, and deep temporal nerves from the anterior division of the inferior maxillary division of the fifth cranial nerve.

Action.—The temporal muscle is a powerful elevator of the lower jaw. Its most posterior fibres, on account of their horizontal direction, also retract the jaw, and thus antagonise the external pterygoid muscle.

Relations.—The *external* or *superficial* surface of the temporal muscle is covered by the temporal fascia, and by the various cutaneous structures which occupy the temporal region. Below the level of the zygoma this surface of the muscle is embedded in a collection of fat which becomes continuous with the buccal pad of fat, already mentioned as lying in the interval between the masseter and buccinator muscles.

The *deep* surface of the temporal muscle rests upon the bones which form the temporal fossa, and from which the muscle arises. Between the muscle and the bones are the deep temporal arteries and nerves.

At the *anterior* border of the temporal muscle, near its lower part, the long buccal nerve and the buccal artery make their appearance and pass forwards.

Behind the *posterior* border, the nerve and artery to the masseter pass outwards through the sigmoid notch of the lower jaw to the deep surface of the masseter.

Dissection.—To completely open into the pterygo-maxillary region, the temporal muscle must now be reflected upwards; this is done by sawing obliquely through the coronoid process of the lower jaw, and then turning it upwards along with the temporal muscle, which is inserted into that process. This having been done, the region may be completely exposed by removing a small portion of the upper part of the ascending ramus of the lower jaw, leaving the condyle of that bone *in situ*.

The External Pterygoid Muscle.—This muscle occupies the zygomatic fossa. It passes almost horizontally backwards to the neck of the lower jaw.

Origin.—The external pterygoid arises by two heads, upper and lower.

The *upper* head arises from the infra-temporal ridge on the external surface of the great wing of the sphenoid bone, and from the zygomatic surface of the same bone.

The *lower* and larger head arises from the external surface of the external pterygoid plate.

Insertion.—From the foregoing origin the muscular fibres pass backwards and slightly outwards, to be inserted into the front of the neck of the lower jaw, and into the interarticular fibro-cartilage of the temporo-maxillary articulation.

Nerve Supply.—The anterior division of the inferior maxillary division of the fifth cranial nerve.

Action.—The external pterygoid protracts the lower jaw in such a way that the incisor teeth of the lower jaw protrude beyond those of the upper jaw. The two muscles acting alternately, produce the grinding action of the molar teeth as used in mastication.

Relations.—The relations of this muscle are of the greatest importance, as, upon a correct appreciation of these, depends the knowledge of the entire region.

The external pterygoid presents for examination an upper and a lower border, an external and an internal surface, and an anterior and a posterior extremity.

Between the *upper border* of the muscle and the bone the middle temporal nerve makes its appearance, and passes upwards to the temporal muscle. A little farther behind this, the posterior deep temporal and the masseteric nerves come out jointly, the former passing upwards, and the latter outwards behind the posterior border of the temporal muscle, to the sigmoid notch of the lower jaw.

At the *lower border* of the external pterygoid two most important nerves make their appearance; these are from before backwards, the lingual and the inferior dental nerves. Along the posterior half of this border of the muscle runs the first part of the internal maxillary artery.

Crossing the *external surface* of the muscle is the second part of the internal maxillary artery, which then disappears between the two heads of the muscle. It must be remembered particularly that this artery is frequently abnormal, in which case it will not occupy the position just described, but will lie deeper than the muscle, and therefore in contact with its *internal surface*.

The *internal or deep surface* of the external pterygoid muscle is in contact with the deep head of the internal pterygoid muscle, with the internal lateral ligament of the lower jaw, with the inferior maxillary division of the fifth nerve, and with the large middle meningeal vessels. It is also, when the internal maxillary artery is abnormally situated, in contact with the second part of this vessel.

At the *anterior extremity* of the muscle, and between its two heads, the anterior deep temporal and the long buccal nerves jointly emerge; the internal maxillary artery disappears at the same place.

At the *posterior border* of the muscle the auriculo-temporal nerve passes upwards.

The Internal Pterygoid Muscle.—This muscle is situated just internal to the ascending ramus of the lower jaw; its position corresponds, therefore, almost exactly to that of the masseter muscle outside the jaw.

Origin.—The internal like the external pterygoid arises by two heads—a small superficial and a larger deep head.

The small *superficial* head arises just outside the external

pterygoid plate, from the tuberosity of the superior maxilla, and from the tuberosity of the palate bone.

The larger and *deeper* head arises from the internal surface of the external pterygoid plate, and from that portion of the tuberosity of the palate bone which fills up the interval between the two pterygoid plates.

Insertion.—From the foregoing origin the muscular fibres pass downwards, backwards, and outwards, to be inserted into the lower half of the internal surface of the ascending ramus of the lower jaw, between the inferior dental foramen and the angle of the lower jaw.

Nerve Supply.—The trunk of the inferior maxillary division of the fifth cranial nerve.

Action.—The internal pterygoid is an elevator of the lower jaw.

Relations.—The *external* surface of the internal pterygoid muscle is in contact with the internal lateral ligament of the temporo-maxillary articulation, with the internal maxillary vessels, and with the inferior dental and lingual nerves, all of which structures separate the muscle from the deep surface of the ascending ramus of the lower jaw.

The deep or *internal* surface of the internal pterygoid muscle is in contact with the superior constrictor muscle of the pharynx, with the tensor palati muscle, and with the ascending palatine artery.

The two heads of the internal pterygoid embrace the lower head of the external pterygoid.

The Internal Maxillary Artery.—This vessel arises within the substance of the parotid gland opposite the neck of the lower jaw, by the bifurcation of the external carotid into superficial temporal and internal maxillary arteries. It terminates on the face, at the infra-orbital foramen, as the infra-orbital artery.

The relations which the artery bears to the external pterygoid muscle permit of its being divided into three parts—first, second, and third.

(a) *The First Part of the Internal Maxillary Artery.*—This part of the vessel passes forwards just below and parallel to the posterior half of the lower border of the external pterygoid muscle.

It has, to its inner side, the internal lateral ligament of the temporo-maxillary articulation, and the inferior dental nerve, whilst above it is the auriculo-temporal nerve, and accompanying it the internal maxillary vein.

(b) *The Second Part of the Internal Maxillary Artery.*—

This part of the vessel passes obliquely upwards and forwards, either superficial to or deeper than the external pterygoid muscle. If the artery is superficial to the muscle, as it is in the so-called normal arrangement, it lies between the external pterygoid and temporal muscles; but if it passes deeper than the external pterygoid muscle—that is, in the so-called abnormal position—it lies above the internal pterygoid muscle, crosses the lingual nerve, and is then seen between the two heads of the external pterygoid muscle, with the buccal nerve, which here lies just above the artery.

(c) *The Third Part of the Internal Maxillary Artery.*—

The third part of the artery disappears between the two heads of the external pterygoid muscle, and, running along the zygomatic surface of the superior maxilla, enters the spheno-maxillary fossa, where it gives off many branches, one of which, the infra-orbital, passes through the infra-orbital canal, to end on the face at the infra-orbital foramen.

Some authorities describe the internal maxillary artery as ending in the spheno-maxillary fossa by breaking up into terminal branches. The method adopted here seems preferable.

Branches.—The branches of the internal maxillary artery are numerous. The one of paramount importance is the large middle meningeal artery, the artery of extra-dural hæmorrhage, which arises from the first part of the internal maxillary artery.

The branches are as follows:—

From the first part—

The large middle meningeal artery.

The inferior dental artery.

The deep auricular artery.

The tympanic artery.

From the second part—

The anterior and posterior deep temporal arteries.

The masseteric artery.

The pterygoid arteries.

The buccal artery.

From the third part—

The posterior superior dental artery.

The descending or superior palatine artery.

The Vidian artery.

The pterygo-palatine artery.

The nasal or spheno-palatine artery.

The infra-orbital artery.

The Large Middle Meningeal Artery.—This very important artery arises from the first part of the internal maxillary artery, and passes upwards on the deep surface of the external pterygoid muscle between the two roots of the auriculo-temporal nerve to the foramen spinosum.

Entering the cranium through this foramen, the artery ramifies in the middle cerebral fossa, where it divides into two branches, which supply the meninges of the brain and the bones of the calvarium.

Before entering the cranium the large middle meningeal artery gives off the *small middle meningeal artery*, which passes upwards on the inner side of the inferior maxillary division of the fifth nerve, and enters the skull through the foramen ovale, to supply the Gasserian ganglion and the dura mater.

The Inferior Dental Artery.—This artery arises opposite the large middle meningeal, and passing downwards enters the inferior dental foramen of the lower jaw with the nerve of the same name.

After supplying the teeth of the lower jaw it gives off a small *mental* branch, which emerges from the substance of the lower jaw at the mental foramen, and anastomoses with the branches of the facial artery.

Before entering the inferior dental foramen the inferior dental artery gives off the *mylo-hyoid* artery, which runs downwards on the deep surface of the ascending ramus of the lower jaw, in the mylo-hyoid groove below the inferior dental foramen, to supply the mylo-hyoid muscle on its superficial surface, between that muscle and the body of the lower jaw.

This small artery is accompanied by the corresponding nerve to the mylo-hyoid.

The Deep Auricular Artery.—This small artery pierces the anterior wall of the external auditory meatus, and supplies the skin of that structure and the tympanic membrane.

The Tympanic Artery.—This variable vessel enters the tympanum through the fissure of Glaser, and supplies the tympanum.

The Anterior and Posterior Deep Temporal Arteries.—These vessels pass upwards between the temporal muscle and the bones of the temporal fossa to supply the temporal muscle.

The Masseteric Artery.—This vessel passes outwards, with the nerve of the same name, behind the posterior border of the temporal muscle, and through the sigmoid notch of the lower jaw to the deep surface of the masseter.

The Pterygoid Arteries.—These are some small irregular branches for the supply of the pterygoid muscles.

The Buccal Artery.—This small artery appears at the lower part of the anterior border of the temporal muscle with the long buccal nerve, and, passing obliquely downwards and forwards across the outer surface of the buccinator muscle, is distributed to the muscles and mucous membrane of the cheek.

The Posterior Superior Dental Artery.—This vessel arises from the third part of the internal maxillary artery near the zygomatic surface of the superior maxilla, down which it passes to enter the substance of the superior maxilla through the posterior dental canals, in order to supply the molar and bicuspid teeth.

The Pterygoid Venous Plexus.—The pterygoid venous plexus corresponds to the second and third parts of the internal maxillary artery. It consists of a large network of veins which covers both surfaces of the external pterygoid muscle.

Most of the tributaries corresponding to the branches of the internal maxillary artery open into it.

Opening out of the plexus there is a vein at each end. Passing forwards from the plexus is the *deep facial vein*; passing backwards from the plexus is the *internal maxillary vein*.

In addition to the veins which open out of either end of the pterygoid venous plexus, communications are also established with the cavernous sinus inside the skull by means of small emissary veins which pass through the foramen ovale, with the ophthalmic veins through the sphenomaxillary fissure, and with the pharyngeal venous plexus.

The Internal Maxillary Vein.—This is a short vessel, which passes backwards from the pterygoid venous plexus, and corresponds to the first part of the artery.

It terminates in the substance of the parotid gland, opposite the neck of the lower jaw, by uniting with the common temporal vein to form the temporo-maxillary venous trunk.

The Deep Facial or the Anterior Maxillary Vein.—This vein is a large vessel which passes forwards from the pterygoid venous plexus, over the zygomatic surface of the superior maxilla, to open into the facial vein just below the malar bone.

The Inferior Maxillary Division of the Fifth Cranial Nerve.—This important nerve constitutes the nerve for the pterygo-maxillary region. It is a mixed nerve, and contains all the fibres of the motor root of the fifth nerve.

The inferior maxillary division of the fifth nerve leaves the skull and enters the pterygo-maxillary region through the foramen ovale.

The trunk of the nerve passes downwards on the deep surface of the external pterygoid muscle for a very short distance, and almost immediately divides into an anterior and a posterior division.

On the deep surface of the trunk of the nerve, just below the foramen ovale, and above the point of its division into anterior and posterior portions, is a small reddish-grey ganglion—the *otic ganglion*.

Branches.—The branches of the inferior maxillary division of the fifth cranial nerve may be classified as follows:—

From the trunk of the nerve—

The nerve to the internal pterygoid muscle.

A recurrent branch.

From the anterior division, chiefly motor—

The anterior, middle, and posterior deep temporal nerves.

The masseteric nerve.

The nerve to the external pterygoid muscle.

The long buccal nerve.

From the posterior division, chiefly sensory—

The lingual nerve.

The inferior dental nerve.

The auriculo-temporal nerve.

The nerve to the mylo-hyoid indirectly.

Branches from the Trunk of the Inferior Maxillary Division of the Fifth Cranial Nerve.—These are two in number, as follows:—

The nerve to the internal pterygoid muscle.

A recurrent branch.

The Nerve to the Internal Pterygoid Muscle.—This nerve, which is closely connected with the otic ganglion, supplies its muscle on the deep surface. It is separated from the lingual and inferior dental nerves by a small inconstant ligament—the *pterygo-spinous ligament*.

The Recurrent Branch.—This minute nerve runs upwards into the skull through the foramen spinosum with the large middle meningeal artery, and supplies the dura mater.

Branches from the Anterior Division of the Nerve Trunk.—The anterior division, which is chiefly motor, gives off four sets of branches, as follows:—

The anterior, middle, and posterior deep temporal nerves.

The masseteric nerve.

The nerve to the external pterygoid muscle.

The long buccal nerve.

The Anterior, Middle, and Posterior Deep Temporal Nerves.—The anterior deep temporal nerve arises in common with the long buccal, and, making its appearance with that nerve in the interval between the two heads of the external pterygoid, supplies the anterior part of the temporal muscle.

The middle deep temporal nerve, which is only occasionally

present, appears at the upper border of the external pterygoid, and supplies the temporal muscle.

The posterior deep temporal nerve appears rather farther back, in common with the masseteric nerve, and also passes to the temporal muscle.

The Masseteric Nerve.—This nerve appears at the posterior part of the upper border of the external pterygoid muscle, in common with the posterior deep temporal nerve. Passing outwards behind the posterior border of the temporal muscle, and through the sigmoid notch of the lower jaw, it supplies the masseter muscle on its deep surface. It is accompanied by the artery to the masseter.

The Nerve to the External Pterygoid Muscle.—This nerve arises in common with the long buccal nerve, and supplies the muscle on its deep surface.

The Long Buccal Nerve.—This, the only sensory nerve given off by the anterior division of the inferior maxillary division of the fifth, arises in common with the anterior deep temporal nerve.

It appears, in common with that nerve, between the two heads of the external pterygoid muscle, and then, passing forwards from under cover of the anterior border of the temporal muscle, it crosses the buccinator muscle, accompanied by the buccal artery, to supply the skin and mucous membrane of the cheek.

Branches from the Posterior Division of the Nerve Trunk.—The posterior division, which is chiefly sensory, gives off four branches, as follows:—

The lingual nerve.

The inferior dental nerve.

The auriculo-temporal nerve.

The nerve to the mylo-hyoid indirectly.

The Lingual Nerve.—This nerve descends on the deep surface of the external pterygoid muscle, in front and to the inner side of the inferior dental nerve.

Making its appearance at the lower border of the external pterygoid muscle, it then inclines rather forwards, and, running between the internal pterygoid muscle and the ascending ramus of the lower jaw, leaves the pterygo-

maxillary region and enters the submaxillary region, where its subsequent course is described. (*See* page 126.)

Near its origin, and whilst it is still under cover of the external pterygoid muscle, the lingual nerve is joined at an acute angle by the *chorda tympani* from the intra-petrous portion of the facial nerve. The *chorda tympani* leaves the petrous portion of the temporal bone through the inner end of the fissure of Glaser.

The Inferior Dental Nerve.—This nerve descends on the deep surface of the external pterygoid muscle, behind and to the outer side of the lingual nerve, and, appearing at the lower border of that muscle, passes downwards between the ascending ramus of the lower jaw and the internal lateral ligament of the temporo-maxillary articulation, to the inferior dental foramen, which it enters.

In the substance of the lower jaw the inferior dental nerve supplies the molar, bicuspid, and canine teeth, and then terminates by dividing into an incisor and a mental branch.

The *incisor* branch passes forwards in the substance of the jaw to supply the incisor teeth, and the *mental* branch emerges at the mental foramen as one of the sensory nerves of the face.

Just before entering the inferior dental foramen the inferior dental nerve gives off the *nerve to the mylo-hyoid*, which accompanies the artery of the same name to the mylo-hyoid muscle, and supplies this muscle and the anterior belly of the digastric.

The Auriculo-Temporal Nerve.—This nerve arises close to the foramen ovale by two roots, which embrace the large middle meningeal artery. It passes first backwards on the deep surface of the external pterygoid muscle, and then, hooking round the lower border of that muscle on the inner side of the neck of the lower jaw, passes upwards between the ear and the temporo-maxillary articulation, on the deep surface of the parotid gland. Emerging at the upper border of the parotid gland, the auriculo-temporal nerve crosses the base of the zygoma with the superficial temporal artery, to become one of the cutaneous nerves of the scalp.

The auriculo-temporal nerve gives branches to the temporo-maxillary articulation, to the external auditory meatus and pinna, and to the parotid gland, in addition to its terminal branches on the scalp.

At its origin the auriculo-temporal nerve is connected to the otic ganglion by some small filaments.

The Chorda Tympani Nerve.—The chorda tympani is a small nerve which arises from the facial in the intra-petrous portion of its course.

The chorda tympani enters the pterygo-maxillary region at the inner end of the Glaserian fissure. It passes downwards and forwards to join the lingual nerve at an acute angle, the point of junction being concealed by the external pterygoid muscle.

The Otic Ganglion.—The otic ganglion is a small reddish-grey ganglion, situated on the inner side of the trunk of the inferior maxillary division of the fifth nerve, just below the foramen ovale.

Immediately to its *inner* side is the cartilaginous part of the Eustachian tube, and the tensor palati muscle, whilst *behind* it is the large middle meningeal artery.

The Roots of the Otic Ganglion.—The roots of the otic ganglion are as follows:—

The *motor* and *sensory* roots are both derived from the inferior maxillary division of the fifth nerve, by means of the nerve to the internal pterygoid muscle.

The *sympathetic* root is derived from the sympathetic plexus on the large middle meningeal artery.

In addition to these three roots, the otic ganglion is also joined by the small superficial petrosal nerve, the continuation onwards of the tympanic nerve or the nerve of Jacobson from the glosso-pharyngeal nerve.

The Branches of Distribution of the Otic Ganglion.—The branches of distribution of the otic ganglion are as follows:—

A few *communicating* branches pass backwards to the auriculo-temporal nerve, and so convey secretory fibres from the glosso-pharyngeal nerve to the parotid gland in the following way:—

The glosso-pharyngeal nerve gives off the nerve of Jacob-

son, which is continued onwards to the otic ganglion as the small superficial petrosal nerve. The otic ganglion gives off communicating branches to the auriculo-temporal nerve, which supplies some filaments to the parotid gland.

A *communicating* branch is given off to the chorda tympani.

Muscular branches are given off from the otic ganglion to two muscles :—

The tensor palati.

The tensor tympani.

The Internal Lateral Ligament.—This ligament is one of the accessory ligaments of the temporo-maxillary articulation; it has important relations to the various structures contained within the pterygo-maxillary region, and is therefore briefly mentioned here.

The internal lateral ligament is a membranous band attached *above* to the spinous process of the sphenoid bone, and *below* to the lingula and adjacent margin of the inferior dental foramen.

It is separated from its joint by the external pterygoid muscle, the internal maxillary artery, and the inferior dental vessels and nerve.

The Pterygo-Spinous Ligament.—This small ligament, only occasionally present, passes from the spinous process of the sphenoid bone to the external pterygoid plate, and when present separates the nerve to the internal pterygoid from the lingual and inferior dental nerves.

VII. THE SUBMAXILLARY REGION

Definition. — The submaxillary region is merely the deeper dissection of the digastric triangle of the neck. It is important to remember that in the living subject this region is almost concealed by the body of the lower jaw.

If the pterygo-maxillary region be defined as constituting the parts lying concealed by the ascending ramus of the lower jaw, then the submaxillary region may be defined, in its turn, as constituting the parts concealed by the body of the lower jaw.

The Elevator Muscles of the Hyoid Bone.—Two of these muscles have already been described. (See page 68.) The remaining two are the mylo-hyoid and genio-hyoid muscles.

The Mylo-Hyoid Muscle.—The mylo-hyoid is an irregularly quadrilateral muscle, which, with its fellow of the opposite side, forms the floor of the mouth.

Origin.—The mylo-hyoid arises from the mylo-hyoid ridge on the deep surface of the body of the lower jaw, extending from the last molar tooth behind, to the symphysis menti in front.

Insertion.—The muscular fibres pass inwards and slightly backwards and downwards, to be inserted into the median raphè between the two muscles in the middle line of the neck, and into the body of the hyoid bone.

Nerve Supply.—The nerve to the mylo-hyoid, from the inferior dental nerve.

Action.—Chiefly an elevator of the hyoid bone. If that bone be fixed the muscle will act as a depressor of the lower jaw.

Relations.—The mylo-hyoid, being irregularly quadrilateral, presents for examination four borders and two surfaces.

The *superior* border corresponds to the origin of the muscle.

The *inferior* border corresponds to that part of the insertion of the muscle which is into the body of the hyoid bone.

The *anterior* border corresponds to that part of the insertion of the muscle which is into the median raphè in the middle line of the body.

The *posterior* border is free, and Wharton's duct hooks round it.

The *superficial surface* of the mylo-hyoid is, in the natural condition of the parts, concealed in great measure by the body of the lower jaw. On this surface there are the anterior belly of the digastric, the submaxillary gland with the facial artery, the mylo-hyoid vessels and nerve, and the submental artery.

The *deep surface* of the mylo-hyoid muscle is in contact

with the greater part of the hyo-glossus and with the numerous structures on the external surface of that muscle. These important structures are mentioned in the description of the hyo-glossus. (See page 124.)

The Submaxillary Gland.—The submaxillary gland may be described as consisting of a large *superficial* portion, which lies superficial to the mylo-hyoid muscle, and of a smaller *deep* portion, which is, as it were, dragged round by Wharton's duct on to the deep surface of the mylo-hyoid muscle.

(a) *The Superficial Portion.*—This portion rests upon the superficial surface of the mylo-hyoid muscle, between it and the deep surface of the body of the lower jaw.

The *external* surface of this part of the submaxillary gland is in contact with the lower jaw, and below that with the skin, fascia, and platysma myoides.

Its *internal* surface rests principally upon the mylo-hyoid muscle, and the facial artery is lodged in a deep groove on this surface of the gland.

In front, it is limited by the anterior belly of the digastric muscle.

Behind, it is separated from the parotid gland by the stylo-maxillary ligament.

(b) *The Deep Portion.*—The deeper and smaller portion of the submaxillary gland hooks round the posterior free border of the mylo-hyoid muscle, along with Wharton's duct, and so comes to lie between the mylo-hyoid and hyo-glossus muscles.

Wharton's Duct.—The duct of the submaxillary gland is termed *Wharton's Duct*. This duct emerges from the main part of the gland, and, accompanied by the deep portion, hooks round the posterior free border of the mylo-hyoid muscle.

Having reached the deep surface of the mylo-hyoid muscle, Wharton's duct runs forwards and slightly upwards on the hyo-glossus muscle, where it is crossed by the lingual nerve. The duct then passes to the inner side of the sub-lingual gland, lying between this gland and the genio-hyo-glossus muscle, and terminates on a small papilla alongside the frænum linguæ in the floor of the mouth.

The Genio-Hyoid Muscle.—The fourth and last elevator muscle of the hyoid bone is the genio-hyoid. Each muscle is

concealed by the corresponding mylo-hyoid muscle. The genio-hyoid muscles are situated on either side of the middle line, and extend from the chin to the hyoid bone.

Origin.—From the inferior genial or mental tubercle on the deep surface of the symphysis menti.

Insertion.—From this origin the muscle passes backwards and very slightly downwards, to be inserted into the body of the hyoid bone.

Nerve Supply.—The hypoglossal nerve.

Action.—An elevator of the hyoid bone, and, if that bone be fixed, a depressor of the lower jaw.

The Extrinsic Muscles of the Tongue.—The extrinsic muscles of the tongue are four in number—the hyo-glossus, the stylo-glossus, the genio-hyo-glossus, and an unimportant muscle termed the chondro-glossus. All these muscles are supplied by the hypoglossal nerve.

The Hyo-Glossus Muscle.—This is a quadrilateral muscle which extends from the hyoid bone to the side of the tongue.

Origin.—The muscle arises, by its inferior border, from the great cornu and part of the body of the hyoid bone.

Insertion.—The muscle passes upwards to be inserted by its superior border into the posterior part of the lateral aspect of the tongue.

Nerve Supply.—The hypoglossal nerve.

Action.—The hyo-glossus retracts and depresses the tongue.

Relations.—The relations of the hyo-glossus are of the greatest importance, as they form a key to the whole sub-maxillary region. They are also of great practical importance in connection with ligation of the lingual artery.

The hyo-glossus muscle, being quadrilateral, presents for examination four borders and two surfaces.

The *inferior* border corresponds to the origin of the muscle.

The *superior* border corresponds to the insertion of the muscle into the side of the tongue. Associated with this border there is the stylo-glossus muscle.

The *anterior* border is free. It rests upon the genio-

hyo-glossus muscle, and the terminal part of the lingual artery reappears from under cover of this border.

The *posterior* border is free. It rests upon the middle constrictor of the pharynx, and, disappearing under cover of this border are the glosso-pharyngeal nerve, the stylo-hyoid ligament, and the lingual artery.

The *superficial surface* is concealed by the mylo-hyoid muscle, with the exception of a small portion at the posterior inferior angle.

Crossing this surface of the muscle more or less transversely, and in order from above downwards, are three important structures:—

The lingual nerve.

Wharton's duct.

The hypoglossal nerve.

The other structures which are found upon this surface of the hyo-glossus, and therefore between this muscle and the mylo-hyoid, are the submaxillary ganglion, the ranine vein accompanying the hypoglossal nerve, and a loop of communication between the lingual and hypoglossal nerves.

The *deep surface* of the hyo-glossus muscle rests upon the genio-hyo-glossus and the middle constrictor of the pharynx. Between these muscles and the deep surface of the hyo-glossus muscle are three important structures:—

The glosso-pharyngeal nerve.

The stylo-hyoid ligament.

The second part of the lingual artery.

The Stylo-Glossus Muscle.—This is a short muscle which passes from the styloid process to the side of the tongue.

Origin.—From the front of the styloid process near its apex, and from the stylo-maxillary ligament.

Insertion.—The muscle passes downwards and slightly forwards and inwards, to be inserted into the side of the tongue as far as its tip, its fibres blending with those of the hyo-glossus near its superior border.

Nerve Supply.—The hypoglossal nerve.

Action.—The stylo-glossus muscle retracts the tongue and elevates its base.

The Genio-Hyo-Glossus Muscle.—This is a fan-shaped

muscle which radiates from the symphysis menti backwards to the tongue and hyoid bone.

Origin.—The genio-hyo-glossus arises by its apex from the upper genial or mental tubercle on the deep surface of the symphysis menti.

Insertion.—From this origin the muscular fibres diverge, to be inserted by the base of the muscle into the whole length of the tongue, and into the body of the hyoid bone.

Nerve Supply.—The hypoglossal nerve.

Action.—The middle fibres of the muscle depress the tongue, the anterior fibres retract the tongue, and the posterior fibres protract the tongue.

Relations.—The genio-hyo-glossus muscles are two fan-shaped muscles, situated vertically, one on either side of the middle line of the body.

Each muscle presents for examination a base, an apex, an upper and a lower border, and two surfaces, internal and external.

The *base* of the genio-hyo-glossus corresponds to the insertion of the muscle.

The *apex* corresponds to the origin.

The *upper* border corresponds to the frænum linguæ.

The *lower* border is in contact with the genio-hyoid muscle.

The *external surface* is in contact with and partly concealed by the hyo-glossus, stylo-glossus, and lingualis inferior muscles. (This last is one of the intrinsic muscles of the tongue.) The sublingual gland and the ranine artery are also in contact with this surface of the muscle.

The *internal surface* of the genio-hyo-glossus is in contact with its fellow of the opposite side.

The Lingual Nerve.—The lingual nerve enters the sub-maxillary region between the internal pterygoid muscle and the ascending ramus of the lower jaw.

It passes forwards and slightly inwards to the side of the tongue, below the mucous membrane of the mouth and across the origin of the superior constrictor muscle of the pharynx. In this position the nerve lies quite superficially below the mucous membrane in the floor of the mouth, and is easily

accessible to the surgeon opposite the last molar tooth of the lower jaw.

The lingual nerve is crossed from below upwards by Wharton's duct, and is then continued onwards to the tip of the tongue just below the mucous membrane.

Branches.—The branches of the lingual nerve may be classified as follows:—

Communicating branches—

The chorda tympani from the facial nerve.

Communicating branch to the hypoglossal.

To the submaxillary ganglion.

Branches of distribution—

To the mucous membrane of the mouth.

To the sublingual gland.

The lingual or terminal branches.

The *communication* between the lingual and hypoglossal nerves is by means of the loop found between these two nerves, on the anterior part of the hyo-glossus muscle.

The *communications* which the lingual nerve establishes with the submaxillary ganglion form the sensory and motor roots for that structure, the motor fibres being derived from the facial nerve by means of the chorda tympani which joins the lingual nerve.

The *lingual or terminal* branches supply the anterior two-thirds of the tongue with *ordinary* sensation derived from the fifth cranial nerve, and with *special* sensation derived from the seventh cranial nerve by means of the chorda tympani.

The Submaxillary Ganglion.—This small ganglion rests upon the upper and posterior part of the hyo-glossus muscle, between it and the mylo-hyoid muscle. It is situated between the lingual nerve from which it appears to be suspended, and Wharton's duct, which is immediately below it.

The Roots of the Submaxillary Ganglion.—The roots of the submaxillary ganglion are as follows:—

The *motor* and *sensory* roots are both apparently derived from the lingual nerve, but the purely motor root is only conveyed indirectly to the ganglion by the lingual nerve—the fibres themselves coming from the facial nerve by means of the chorda tympani and the lingual nerves.

The *sympathetic* root is derived from the plexus on the facial artery.

The Branches of Distribution of the Submaxillary Ganglion.—The branches of distribution of the submaxillary ganglion are as follows:—

Small filaments are given off to the submaxillary gland.

Branches to the mucous membrane of the mouth.

Branches to Wharton's duct.

The Hypoglossal Nerve.—The hypoglossal nerve, which has already been described in its course through the anterior triangle (*see* page 70), enters the submaxillary region under cover of the posterior belly of the digastric and stylo-hyoid muscles and the mylo-hyoid muscle.

The nerve then crosses the hyo-glossus muscle transversely, being accompanied by the ranine vein, and lying at a slightly higher level than the lingual artery, from which it is here separated by the hyo-glossus itself. At the anterior border of the hyo-glossus muscle the lingual artery, as it is ascending to the tip of the tongue, appears just above the nerve, which terminates about this place in branches which pierce and supply the genio-hyo-glossus muscle and the intrinsic muscles of the tongue. At the anterior part of the hyo-glossus muscle there is a loop of communication between the hypoglossal and lingual nerves.

Branches.—The branches given off by the hypoglossal nerve in the *submaxillary region* are as follows:—

Muscular branches to—

The stylo-glossus . . .	} Extrinsic muscles of the
The hyo-glossus . . .	
The chondro-glossus . . .	
The genio-hyo-glossus . . .	
The intrinsic muscles of the tongue.	
The genio-hyoid . . . Elevator of the hyoid bone.	

Communicating branch to the lingual nerve.

The Sublingual Gland.—This, the smallest of the three salivary glands, is about the size of an almond. It is situated in the floor of the mouth, and extends from the frænum linguæ in front, backwards and outwards, for a distance of about one inch.

The sublingual gland has very definite relations, as follows:—

Above, it is only separated from the floor of the mouth by the mucous membrane.

Below, the sublingual gland rests upon the mylo-hyoid muscle.

Internally, it is in contact with the genio-hyo-glossus muscle.

Externally, the sublingual gland occupies a small, but distinct fossa situated on the deep surface of the body of the lower jaw immediately external to the symphysis menti.

The *anterior extremity* of the sublingual gland is in contact with its fellow of the opposite side in the middle line of the body just above the upper border of the genio-hyo-glossus muscle.

The ducts of the sublingual gland are from eight to twenty in number, and are termed the *ducts of Rivinus*, the largest one being sometimes specially named the *duct of Bartholin*. These ducts open into the floor of the mouth, and also into Wharton's duct.

The Lingual Artery.—This important vessel arises from the external carotid artery, between the superior thyroid and facial arteries, opposite the great cornu of the hyoid bone.

It first passes upwards and then bends sharply downwards, thus forming a small loop, which rests upon the middle constrictor of the pharynx, and which is crossed by the hypoglossal nerve.

The lingual artery then passes forwards under cover of the posterior belly of the digastric and the stylo-hyoid muscles, and then along the inner surface of the hyo-glossus muscle, as far as the anterior border of that muscle, where it turns upwards to the tip of the tongue, resting in the latter part of its extent upon the genio-hyo-glossus muscle.

The relation which the lingual artery bears to the hyo-glossus muscle is very important in connection with ligation of the vessel. The hyo-glossus muscle crosses the lingual artery in the same way that the scalenus anticus muscle crosses the subclavian artery; and thus the lingual artery

may be divided into three parts—a part before it reaches the hyo-glossus, a part under cover of that muscle, and a terminal portion in front of that muscle.

The *first* part rests upon the middle constrictor muscle of the pharynx, and the second and third parts upon the genio-hyo-glossus muscle.

The *second* part of the vessel is separated from the hypoglossal nerve by the hyo-glossus muscle, the nerve lying at a slightly higher level.

At the anterior border of the hyo-glossus the *third* part of the artery ascends to the tip of the tongue, and is therefore seen at a slightly higher level than the nerve.

Branches.—The branches of the lingual artery are as follows:—

From the first part—

A supra-hyoid branch.

From the second part—

The dorsalis linguæ.

From the third part—

The ranine artery.

The sublingual artery.

The Supra-Hyoid Artery.—The small hyoid or supra-hyoid artery runs along the upper border of the hyoid bone, supplying the muscles of that region.

The Dorsalis Linguæ.—The dorsalis linguæ is an important vessel arising from the second part of the lingual artery, on the deep or internal surface of the hyo-glossus muscle in front of its posterior border. Ascending to the dorsum of the tongue, it supplies the substance of the tongue and its mucous membrane. This artery is not unusually represented by two or more branches.

The Ranine Artery.—The ranine artery commences at the anterior border of the hyo-glossus, and pursues a tortuous course to the tip of the tongue. In the greater part of its extent it is embedded in the substance of the genio-hyo-glossus and lingualis inferior muscles. In the last part of its course the ranine artery lies quite superficially in the frænum linguæ, and anastomoses with its fellow of the opposite side in a small loop.

The Sublingual Artery.—The sublingual artery arises at the anterior border of the hyo-glossus muscle, and passes forwards between the genio-hyo-glossus muscle and the sublingual gland, both of which it supplies.

The Lingual Veins.—The venous return from the tongue passes backwards by three venous trunks:—

The ranine vein.

Two venæ comites.

The dorsal veins of the tongue.

The Ranine Vein.—This, the largest of the veins of the tongue, commences at the tip of the tongue, and passes backwards across the genio-hyo-glossus, and then accompanies the hypoglossal nerve across the hyo-glossus muscle, to terminate in the internal jugular vein.

Two Small Venæ Comites.—These small veins accompany the lingual artery itself, and terminate in the internal jugular vein.

The Dorsal Veins of the Tongue.—The dorsal veins of the tongue commence in a venous plexus on the dorsal surface of the tongue, and, passing downwards, terminate in the internal jugular vein.

The Glosso-Pharyngeal Nerve.—This nerve is described with the deep dissection of the neck. (See page 136.)

The Stylo-Hyoid Ligament.—This is a thin fibrous cord which passes from the apex of the styloid process, and, disappearing behind the posterior border of the hyo-glossus muscle, is attached below to the lesser cornu of the hyoid bone.

VIII. THE DEEP DISSECTION OF THE NECK

In this region there are many important structures. Attached to the styloid process there are three muscles and two ligaments.

The three *muscles* are the stylo-hyoid, the stylo-glossus, and the stylo-pharyngeus muscles.

The two *ligaments* are the stylo-maxillary ligament and the stylo-hyoid ligament.

Particular attention must be paid to the three muscles

attached to the styloid process, as they belong to three different groups; thus:—

1. Stylo-hyoid. Elevators of hyoid bone.	{	1. Stylo-hyoid.	{	Facial nerve.
		2. Digastric— Posterior belly.		
		Anterior belly.	{	Trigeminal nerve.
		3. Mylo-hyoid.		
2. Stylo-glossus. Extrinsic muscles of tongue.	{	4. Genio-hyoid.	Hypoglossal nerve.	
		1. Stylo-glossus.	{	Hypoglossal nerve.
		2. Hyo-glossus.		
		3. Genio-hyo-glossus.		
		4. Chondro-glossus.		
3. Stylo-pharyngeus. Muscles of pharynx.	{	1. Stylo-pharyngeus.	{	Glosso-pharyngeal nerve.
		2. Superior constrictor of pharynx.		
		3. Middle constrictor of pharynx.	{	Pharyngeal plexus.
		4. Inferior constrictor of pharynx.		

The Stylo-Pharyngeus Muscle.—This muscle, the longest of the three muscles attached to the styloid process, extends from that process to the lateral wall of the pharynx.

Origin.—From the inner side of the root of the styloid process.

Insertion.—From this origin the muscle passes downwards, and, disappearing between the superior and middle constrictors of the pharynx, runs down in the wall of the pharynx on the deep surface of the middle constrictor, to be inserted into the superior and posterior borders of the thyroid cartilage, and into the lateral wall of the pharynx.

Nerve Supply.—The glosso-pharyngeal nerve.

Action.—The stylo-pharyngeus muscle is the principal elevator muscle of the pharynx and larynx.

Relations.—The glosso-pharyngeal nerve runs down along the posterior border of the muscle, and then turns forwards across the external surface of the muscle, just before it disappears from view between the two constrictors. This relation of the glosso-pharyngeal nerve to the muscle forms an important factor in their recognition.

The Internal Carotid Artery.—The internal carotid artery commences at the upper border of the thyroid cartilage opposite the fourth cervical vertebra, by the bifur-

cation of the common carotid artery into internal and external carotids.

It terminates inside the cranium on the inner side of the anterior clinoid process of the sphenoid bone, by dividing into anterior and middle cerebral arteries.

To reach the inside of the cranium, the internal carotid artery takes a tortuous course through the petrous portion of the temporal bone, and thus permits of the division of the artery into three parts—a part within the neck, a part within the petrous portion of the temporal bone, and a part within the cranium.

The First Part, or the Intra-cervical Portion of the Internal Carotid Artery.—This part commences at the place, and in the manner already indicated, and terminates at the entrance to the carotid canal by becoming directly continuous with the second or intra-petrous portion.

General Relations.—Below the level of the posterior belly of the digastric and stylo-hyoid muscles the internal carotid artery is comparatively superficially situated, lying on the same level as, though somewhat posterior to, the external carotid artery. It is here only covered by the skin, fasciæ, platysma myoides muscle, and overlapped by the anterior border of the sterno-mastoid muscle.

Above the level of the digastric the artery is very deeply situated, being now nearer the middle line of the body than the external carotid, and covered by the parotid gland, and crossed by the styloid process and the stylo-pharyngeus muscle.

To the *inner* side of the internal carotid artery are the pharynx and the tonsil.

Behind the internal carotid is the rectus capitis anticus major muscle—one of the prevertebral muscles—which separates the artery from the cervical vertebræ.

Relations of the Internal Carotid Artery to Vessels.—The internal jugular vein lies to the outer side of the artery.

The posterior auricular artery from the external carotid crosses the artery from before backwards at the upper border of the posterior belly of the digastric, whilst the

occipital artery crosses the internal carotid in a similar way, but at the lower border of the digastric.

Relations of the Internal Carotid Artery to Nerves.—At the base of the skull the internal carotid artery is separated from the internal jugular vein by the glosso-pharyngeal, pneumogastric, spinal accessory, and hypoglossal nerves.

Crossing the artery superficially, and in order from above downwards, are the glosso-pharyngeal, the pharyngeal branch of the vagus, and the hypoglossal nerves.

Crossing the artery on its deep or pharyngeal surface are the internal and external laryngeal nerves.

Passing vertically downwards, between the artery and the internal jugular vein, is the pneumogastric or vagus nerve.

Passing vertically downwards behind the artery is the gangliated cord of the sympathetic nerve.

The Second or Intra-petrous Portion of the Internal Carotid Artery.—This part of the vessel lies within the carotid canal in the petrous portion of the temporal bone. It first passes upwards, then forwards and inwards, and lastly, again upwards.

The vessel first passes upwards in front of the tympanum and cochlea, from which it is only separated by an extremely thin plate of bone, so thin as to be translucent by transmitted light.

Whilst passing forwards and inwards, the vessel has the Eustachian tube to its outer side; and immediately above it, and only separated from it by a thin process of dura mater, is the Gasserian ganglion.

Lastly, the vessel turns upwards into the cavity of the skull, ascending in the groove between the lingula and petrosal process of the sphenoid bone. The relations of the second part of the internal carotid artery are of considerable practical importance.

The Ascending Pharyngeal Artery.—This vessel arises from the external carotid artery at, or near, the angle of its junction with the internal carotid. It passes vertically upwards between the internal carotid artery and the lateral wall of the pharynx, to terminate near the base of the skull in pharyngeal and meningeal branches.

Branches.—The ascending pharyngeal artery gives off small and unimportant pharyngeal, prevertebral, meningeal, and tympanic branches.

The Internal Jugular Vein.—This vein commences at the posterior compartment of the jugular foramen as the direct continuation of the lateral sinus, and, after passing vertically downwards through the neck, terminates behind the inner end of the clavicle by uniting with the subclavian vein to form the innominate vein of its own side.

At the base of the skull the internal jugular vein lies behind the internal carotid artery with the rectus capitis lateralis muscle to its inner side, but below this it lies to the outer side of, first, the internal, and afterwards the common carotid arteries. The internal jugular vein and common carotid artery are enclosed in the carotid sheath, with the vagus nerve between them.

Tributaries.—The tributaries of the internal jugular vein are as follows:—

The inferior petrosal sinus.

The pharyngeal veins.

The lingual veins.

The common facial vein.

The superior thyroid vein.

The middle thyroid vein.

The thoracic duct on the left side, and the lymphatic duct on the right side.

The Inferior Petrosal Sinus.—The inferior petrosal sinus, one of the venous sinuses of the cranial cavity, leaves the skull through the anterior compartment of the jugular foramen, and, passing backwards to the outer side of the glossopharyngeal, vagus, and spinal accessory nerves, terminates in the internal jugular vein.

The Pharyngeal Veins.—These veins form a plexus upon the posterior and lateral walls of the pharynx, from which two or three veins pass to open into the internal jugular vein about the level of the hyoid bone.

The Lingual Veins.—These are the ranine, the venæ comites of the lingual artery, and the dorsalis linguæ veins. They either open separately or by a common trunk into the

internal jugular vein near the hyoid bone. Occasionally they may terminate in the common facial vein instead of in the internal jugular.

The Common Facial Vein.

The Superior Thyroid Vein.—Both these veins open into the internal jugular at the level of the hyoid bone.

The Middle Thyroid Vein.—This terminates in the internal jugular opposite the cricoid cartilage.

The Right Lymphatic Duct and the Thoracic Duct.—These two structures terminate, on their respective sides, at the outer angle of junction of the internal jugular vein with the subclavian vein.

The Glosso-Pharyngeal or the Ninth Cranial Nerve.—This nerve leaves the skull through the middle compartment of the jugular foramen and appears in the deep dissection of the neck in the interval between the internal carotid artery and the internal jugular vein.

The nerve runs along the posterior border of the stylo-pharyngeus muscle, and crosses the internal carotid artery superficially and from behind forwards. Still inclining forwards, the nerve crosses the stylo-pharyngeus muscle on its outer surface, and finally disappears behind the posterior border of the hyo-glossus muscle, to terminate in branches for the supply of the posterior third of the tongue.

In connection with this nerve there are two ganglia—the jugular ganglion and the petrosal ganglion.

The Upper or Jugular Ganglion.—The jugular ganglion is very small, and is not always present. It is situated at the upper part of the osseous groove in which the nerve lies during its passage through the jugular foramen.

The Lower or Petrosal Ganglion.—The petrosal ganglion is situated in a slight depression on the posterior border of the petrous portion of the temporal bone. From this ganglion various communicating branches are given off, and one branch of distribution, the tympanic nerve or the nerve of Jacobson, as follows:—

Communicating branches from the petrosal ganglion—

To the ganglion of the root of the vagus. Inconstant.

To the auricular branch of the pneumogastric.

To the superior cervical ganglion of the sympathetic.

Branch of distribution—

The nerve of Jacobson, or the tympanic nerve.

The Nerve of Jacobson, or the Tympanic Nerve.—This nerve passes upwards from the petrosal ganglion, accompanied by the tympanic branch of the ascending pharyngeal artery, to a small canal situated upon the ridge of bone between the jugular fossa and the carotid canal, and by means of this canal enters the tympanum. Having reached the inner wall of the tympanic cavity, the nerve passes upwards and forwards in a small groove on the surface of the promontory, and then turning forwards it leaves the tympanum at its upper and anterior part, and, changing its name, becomes the small superficial petrosal nerve.

Branches of the Nerve of Jacobson.—The nerve of Jacobson gives off the following branches within the cavity of the tympanum:—

To the mucous membrane of the middle ear—

One forwards to the Eustachian tube.

One backwards to the Fenestra rotunda.

One backwards to the Fenestra ovalis.

One to the mastoid cells.

Communicating branches which give rise to the tympanic plexus—

The small superficial petrosal nerve.

The small deep petrosal nerve.

One or two carotico-tympanic twigs.

The *small superficial petrosal nerve*, which is merely the continuation onwards of the nerve of Jacobson, communicates with the geniculate ganglion of the facial nerve, and then passes onwards through a small canal which crosses the upper end of the canal of the tensor tympani muscle on a lower level, and then emerges on the antero-superior surface of the petrous temporal, just external to the hiatus Fallopii. Turning downwards, the small superficial petrosal nerve leaves the cranial cavity through the fissure between the petrous temporal and the great wing of the sphenoid bone, and terminates in the otic ganglion.

The *small deep petrosal nerve* passes forwards in a minute canal in the *processus cochleariformis* and enters the horizontal part of the carotid canal, in which it joins the carotid plexus of the sympathetic on the outer side of the second or intrapetrous portion of the internal carotid artery.

The *carotico-tympanic twigs* pass downwards and forwards through the anterior wall of the tympanum to the carotid canal, in which they join the external division of the ascending or carotid branch of the gangliated cord of the sympathetic nerve on the outer side of the second part of the internal carotid artery, to form the carotid plexus.

Branches of Distribution of the Glosso-Pharyngeal Nerve.—These are as follows:—

Pharyngeal branches.

Muscular to the stylo-pharyngeus muscle.

Tonsillar branches.

Terminal or lingual branches.

The Pharyngeal Branches of the Glosso-Pharyngeal Nerve.—The largest of these branches descends obliquely across the outer side of the internal carotid artery to unite with the pharyngeal branches of the vagus and of the sympathetic to form the *pharyngeal plexus*. This plexus supplies the constrictor muscles and mucous membrane of the pharynx, and all the muscles of the soft palate except the *tensor palati*.

A *muscular* branch is given off by the glosso-pharyngeal nerve to the stylo-pharyngeus muscle.

Tonsillar Branches.—Small tonsillar branches are given off near the base of the tongue to the tonsil, soft palate, and pillars of the fauces.

Terminal or Lingual Branches.—The terminal branches of the glosso-pharyngeal nerve supply the posterior third of the tongue and the anterior surface of the epiglottis.

The Pneumogastric, Vagus, or Tenth Cranial Nerve.—This, the longest of all the cranial nerves, leaves the skull through the middle compartment of the jugular foramen. It descends through the neck and the superior and middle mediastina of the thorax, into the abdomen.

In the neck the vagus nerve descends between the internal

jugular vein and the internal carotid artery, and afterwards in the carotid sheath between the internal jugular vein and the common carotid artery.

In connection with this nerve there are two ganglia—an upper ganglion or the ganglion of the root, and a lower ganglion or the ganglion of the trunk.

The Upper Ganglion, or the Ganglion of the Root.—The ganglion of the root is very small, and is situated in the jugular foramen.

Its *branches* may be classified as follows:—

Communicating branches from the ganglion of the root—

To the petrosal ganglion of the glosso-pharyngeal nerve. Inconstant.

To the spinal accessory nerve.

To the superior cervical ganglion of the sympathetic.

Branches of distribution—

The recurrent or the meningeal branch.

The auricular branch, or the nerve of Arnold.

The Lower Ganglion, or the Ganglion of the Trunk of the Vagus.—This is a large cylindrical fusiform swelling about one inch in length, which is situated on the trunk of the vagus nerve just below the base of the skull.

The accessory part of the spinal accessory nerve is thrown into this ganglion, and is in part continued into the pharyngeal, external laryngeal, recurrent laryngeal, and cardiac branches of the vagus; that is to say, the motor branches of the vagus nerve derive their fibres from the spinal accessory nerve.

The *branches* of the ganglion of the trunk of the vagus may be classified as follows:—

Communicating branches from the ganglion of the trunk—

To the hypoglossal nerve.

To the superior cervical ganglion of the sympathetic.

To the loop between the anterior primary divisions of the first and second cervical spinal nerves.

Branches of distribution—

The pharyngeal branch.

The superior laryngeal nerve.

The branches of distribution from the two ganglia of the vagus are described in the next paragraph along with all the other branches of distribution from the nerve trunk within the neck.

The Branches of Distribution of the Vagus Nerve within the Neck.—The *branches of distribution*, which arise from the vagus nerve within the neck, may be enumerated as follows:—

From the ganglion of the root—

1. The recurrent or the meningeal branch.
2. The auricular branch, or the nerve of Arnold.

From the ganglion of the trunk—

3. The pharyngeal branch.
4. The superior laryngeal nerve.
 - (a) Internal laryngeal.
 - (b) External laryngeal.

From the trunk of the vagus—

5. Cervical cardiac branches.
6. The inferior or recurrent laryngeal nerve.

Right side only.

The Recurrent or Meningeal Branch.—This minute nerve arises from the ganglion of the root of the vagus, and passes into the skull through the jugular foramen, to supply the dura mater in the posterior cerebral fossa.

The Auricular Branch, or the Nerve of Arnold.—This small nerve arises from the ganglion of the root. It is connected to the petrosal ganglion of the glosso-pharyngeal nerve, and then passes backwards along the outer side of the jugular foramen to a small foramen near the root of the styloid process. Entering this foramen it gains the substance of the petrous temporal, and, crossing the lower end of the aqueduct of Fallopius on its inner side, it communicates with the facial nerve, and finally emerges from the substance of the petrous temporal by a small foramen situated between the external auditory meatus and the mastoid process.

The nerve terminates by dividing into two parts, *one*

of which communicates with the posterior auricular nerve, and *the other* supplies the skin of the ear, and the back part of the external auditory meatus. It is the presence of the latter branch which explains the occasional occurrence of ear-ache in gastric disorders, as the vagus nerve supplies both the ear and the stomach, and the pain is referred from one structure to the other.

The Pharyngeal Branch.—The pharyngeal branch of the vagus arises from the ganglion of the trunk of the vagus, and is mainly composed of fibres thrown into the vagus by the accessory portion of the spinal accessory nerve. It crosses the outer side of the internal carotid artery obliquely, and takes part in the formation of the *pharyngeal plexus*.

The Superior Laryngeal Nerve.—This important nerve arises from the middle of the ganglion of the trunk of the vagus. It descends on the internal or deep surface of the internal carotid artery, under cover of which it terminates by dividing into internal and external laryngeals.

(a) The *internal laryngeal nerve* continues the direction of the superior laryngeal nerve, and, gaining the interval between the hyoid bone and the thyroid cartilage, pierces the thyro-hyoid membrane, accompanied by the superior laryngeal branch of the superior thyroid artery, and breaks up into numerous branches for the supply of the mucous membrane of the interior of the larynx. This nerve is thus the great sensory nerve of the larynx, and conveys sensory impressions from the larynx.

(b) The *external laryngeal nerve* arises on the inner side of the internal carotid artery by the bifurcation of the superior laryngeal into internal and external laryngeal nerves. It passes downwards and forwards, under cover of the depressor muscles of the hyoid bone, to the crico-thyroid muscle, which it supplies and in which it ends.

The Cervical Cardiac Branches.—These branches are usually two or three in number. They arise from the upper and lower parts of the vagus in the neck.

The inferior cervical cardiac branch of the left side crosses the arch of the aorta on its left side, and terminates in the

superficial cardiac plexus; the remainder terminate in the deep cardiac plexus.

The Inferior or Recurrent Laryngeal Nerve.—On the *right* side, the inferior or recurrent laryngeal nerve arises at the root of the neck, and recurs round the first part of the subclavian artery, but on the *left* side it arises from the vagus within the thorax, and recurs round the arch of the aorta.

On *both* sides, the nerve passes upwards and inwards behind the carotid sheath, and either behind or in front of the inferior thyroid artery, to the groove between the trachea and œsophagus. The nerve ascends in this groove until it reaches the cricoid cartilage, where it enters the larynx by disappearing under cover of the inferior constrictor muscle of the pharynx.

The inferior or recurrent laryngeal nerve is the great motor nerve of the larynx, and supplies all the intrinsic muscles of that organ, with the exception of the crico-thyroid muscle, which is supplied by the external laryngeal nerve. This nerve also supplies branches to the trachea and œsophagus, and occasionally to the inferior constrictor muscle of the pharynx.

The Spinal Accessory, or the Eleventh Cranial Nerve.—

This nerve consists of two portions:—

A bulbar or medullary portion, accessory to the vagus.

A spinal portion, forming the spinal accessory nerve as seen within the triangles of the neck.

The Bulbar or Medullary Portion, Accessory to the Vagus.—

This portion of the nerve arises from the medulla oblongata or bulb, and terminates by joining the vagus nerve. Passing through the middle compartment of the jugular foramen, it is connected to the ganglion of the root of the vagus by one or two filaments, and eventually blends with the ganglion of the trunk of the vagus, sending its fibres into the pharyngeal, external laryngeal, recurrent laryngeal, and cardiac branches of the vagus.

The Spinal Portion.—This portion of the nerve arises from the cervical portion of the spinal cord by a series of filaments which make their appearance near the dorso-lateral

fissure of the cord, as low down as the fifth or sixth cervical nerves.

Passing upwards between the ligamentum denticulatum and the posterior roots of the cervical nerves, this portion of the eleventh cranial nerve enters the skull through the foramen magnum, and immediately turns outwards to enter the middle compartment of the jugular foramen, where it unites with the bulbar root for a short distance, and then, issuing from the jugular foramen as a single nerve trunk once more, the *spinal* portion is directed backwards, and, crossing the internal jugular vein usually on its outer side, perforates the sterno-mastoid muscle which it supplies, and then, crossing the posterior triangle, disappears from view under the anterior border of the trapezius.

Under cover of the trapezius the spinal portion of the spinal accessory nerve forms a plexus with some branches from the third and fourth cervical nerves, which supply the trapezius, and extend nearly to its lower border.

The Hypoglossal or the Twelfth Cranial Nerve.—This nerve leaves the skull through the anterior condylar foramen, and is very deeply situated on the inner sides of the internal jugular vein, the internal carotid artery, and the vagus nerve.

The hypoglossal nerve then turns forwards between these vessels and round the ganglion of the trunk of the vagus nerve, which is here lying between the two vessels. Descending in this position, the nerve gradually becomes more superficial until it reaches the lower border of the posterior belly of the digastric muscle, where it changes its direction, and passes transversely forwards, curving round the occipital artery.

The subsequent course of this nerve has already been described. (*See* pages 70 and 128.)

Branches.—The branches of the hypoglossal nerve may be classified as follows:—

Communicating branches—

To the ganglion of the trunk of the vagus.

To the superior cervical ganglion of the sympathetic.

To the loop between the anterior primary divisions of the first and second cervical nerves.

To the lingual nerve, in the submaxillary region.

Branches of distribution—

The descendens hypoglossi.

The nerve to the thyro-hyoid muscle.

Muscular branches—

To all the extrinsic muscles of the tongue.

To all the intrinsic muscles of the tongue.

To the genio-hyoid muscle.

The Gangliated Cord of the Sympathetic within the Neck.—The gangliated cord of the sympathetic is deeply situated in the neck, lying between the prevertebral muscles and the common carotid and internal carotid arteries.

Whilst, as a general rule, there is a ganglion on the sympathetic for each spinal nerve, there are in this region only three ganglia, not eight; these three ganglia are named the superior, middle, and inferior cervical ganglia.

The Superior Cervical Ganglion.—This, the largest of the three ganglia, is situated opposite the second and third cervical vertebræ, and lies between the internal carotid artery and the rectus capitis anticus major muscle. As this ganglion communicates with the first four cervical nerves, it is probable that it represents the first four sympathetic ganglia fused together.

Branches.—The branches of the superior cervical ganglion may be classified as follows:—

Branches of communication—

To the first four cervical nerves.

To the ganglion of the trunk of the vagus.

To the hypoglossal nerve.

A fourth branch connects this ganglion with both the petrosal ganglion of the glosso-pharyngeal nerve, and also with the ganglion of the root of the vagus.

Branches of distribution—

The ascending or carotid branch.

Pharyngeal branches.

The superior cervical cardiac nerve.

Vascular branches.

The Ascending or Carotid Branch.—This small nerve runs upwards with the internal carotid artery into the carotid canal. It represents the continuation upwards of the gangliated cord of the sympathetic itself.

On entering the carotid canal the ascending or carotid branch divides into two—an external division on the outer side of the internal carotid artery, and an internal division on the inner side of the artery.

(a) *The external division.*—The external division is joined by the carotico-tympanic filaments from the nerve of Jacobson, and forms in this way the *carotid plexus*.

(b) *The internal division.*—The internal division of the ascending or carotid branch of the gangliated cord of the sympathetic passes upwards on the inner sides of the second and third parts of the internal carotid artery to form the *cavernous plexus*, which is prolonged onwards with the ophthalmic and cerebral arteries.

The Pharyngeal Branches.—The pharyngeal branches of the sympathetic pass downwards and inwards on the outer side of the internal carotid artery to the pharyngeal plexus.

The Superior Cervical Cardiac Branch.—This branch passes downwards in the back of the carotid sheath, and in front of the inferior thyroid artery to the thorax. The nerve of the right side ends in the deep cardiac plexus, that of the left side in the superficial cardiac plexus.

Vascular Branches.—Vascular branches are given off to the external carotid artery and to its various branches. The sympathetic on the facial artery furnishes the sympathetic root to the submaxillary ganglion.

The Middle Cervical Ganglion.—This, the smallest of the three cervical ganglia, is situated opposite the inferior thyroid artery, about the level of the sixth or seventh cervical vertebræ.

Branches.—Its branches may be classified as follows:—

Branches of communication—

To the fifth and sixth cervical nerves.

Branches of distribution—

Thyroid branches.

The middle cervical cardiac branch.

Thyroid Branches.—These are given off from the inner side of the ganglion, and pass to the thyroid body with the inferior thyroid artery.

The Middle Cervical Cardiac Branch.—This nerve passes down into the thorax, to terminate, on both sides, in the deep cardiac plexus.

The Inferior Cervical Ganglion.—This ganglion is very frequently fused with the first thoracic ganglion. It usually lies opposite the first costo-central articulation, in the angle between the subclavian and vertebral arteries.

Branches.—The branches of this ganglion may be classified as follows:—

Branches of communication—

To the seventh and eighth cervical nerves.

Branches of distribution—

The inferior cervical cardiac nerve.

Vascular branches.

The Inferior Cervical Cardiac Branch.—This nerve passes, on both sides, into the thorax to the deep cardiac plexus.

Vascular Branches.—Vascular branches are given off to the vertebral artery.

The Carotid Plexus.—The carotid plexus is situated on the outer side of the second or intra-petrous portion of the internal carotid artery. It is formed by the junction of—

The external division of the ascending or carotid branch of the gangliated cord of the sympathetic.

The carotico-tympanic filaments from the nerve of Jacobson.

Branches.—The branches from the carotid plexus are as follows:—

A communicating branch to the Gasserian ganglion of the fifth cranial nerve.

A communicating branch to the sixth cranial nerve.

The great deep petrosal nerve.

The small deep petrosal nerve.

The Great Deep Petrosal Nerve.—The great deep petrosal nerve passes forwards from the anterior part of the carotid plexus to the posterior end of the Vidian canal, where it is joined by the great superficial petrosal nerve from the facial,

to form the Vidian nerve, which passes through the Vidian canal to terminate in Meckel's ganglion on the superior maxillary division of the fifth cranial nerve.

The Small Deep Petrosal Nerve.—This nerve connects the carotid plexus with the tympanic plexus and the nerve of Jacobson. Its course has been described on page 138.

The Cavernous Plexus.—The cavernous plexus is situated on the inner side of the third or intra-cranial portion of the internal carotid artery. It is formed by the internal division of the ascending or carotid branch of the gangliated cord of the sympathetic.

Branches.—The branches from the cavernous plexus are as follows:—

A communicating branch to the third cranial nerve.

A communicating branch to the fourth cranial nerve.

Communicating branches to the ophthalmic division of the fifth cranial nerve.

The sympathetic root of the ciliary ganglion.

Branches to the pituitary body.

The Anterior Primary Division of the First Cervical or Suboccipital Nerve.—The anterior primary division of the first cervical or suboccipital nerve passes forwards above the transverse process of the atlas, and on the inner side of the vertebral artery, to the interval between the rectus capitis lateralis and rectus capitis anticus minor muscles. Making its appearance between these two muscles, the nerve turns downwards in front of the transverse process of the atlas and forms a loop—which is part of the cervical plexus—with the anterior primary division of the second cervical nerve.

Branches.—The branches which are derived from the nerve loop between the anterior primary divisions of the first and second cervical nerves are as follows:—

Communicating branches—

To the ganglion of the trunk of the vagus.

To the hypoglossal nerve; the spinal fibres so thrown into that nerve proceed to all the muscles supplied by the hypoglossal with the exception of the extrinsic and intrinsic muscles of the tongue.

To the superior cervical ganglion of the sympathetic.

Muscular branches—

To the rectus capitis anticus major.

To the rectus capitis anticus minor.

To the rectus capitis lateralis.

The Cervical Plexus.—The cervical plexus is formed by the anterior primary divisions of the first four cervical nerves. With the exception of the first cervical nerve, each one divides into an ascending and a descending branch, which unite together to form the plexus, which thus consists of three nerve loops. The descending branch from the anterior primary division of the fourth cervical nerve is very small, and usually descends to unite with the anterior primary division of the fifth cervical nerve to take part in the formation of the brachial plexus.

The cervical plexus lies behind the sterno-mastoid muscle, and in front of the scalenus medius and levator anguli scapulæ muscles, opposite the upper four cervical vertebræ.

Branches.—The branches of the cervical plexus, which are very numerous, may be classified as follows:—

SUPERFICIAL . . .	{	<i>Ascending</i>	{	Small occipital.
			{	Great auricular.
	{	<i>Descending</i>	{	Superficial cervical.
			{	Supra-sternal.
	{		{	Supra-clavicular.
			{	Supra-acromial.
	{		{	Communicating.
			{	Muscular.
DEEP	{	<i>Internal</i>	{	Rami communicantes hypoglossi.
			{	The phrenic nerve.
	{	<i>External</i>	{	Communicating.
			{	Muscular.

The Superficial Branches.—The superficial branches, both ascending and descending, have been described on page 38.

The Internal Series of Deep Branches.—The internal series of deep branches are as follows:—

Communicating.

Muscular.

Rami communicantes hypoglossi.

The phrenic nerve.

Communicating Branches.—The nerve loop formed by the anterior primary divisions of the first and second cervical nerves gives off communicating branches to the following nerves:—

To the ganglion of the trunk of the vagus.

To the hypoglossal nerve.

To the superior cervical ganglion of the sympathetic.

Muscular Branches.—The nerve loop between the first and second cervical nerves gives off muscular branches to:—

The rectus capitis anticus major.

The rectus capitis anticus minor.

The rectus capitis lateralis.

The third and fourth cervical nerves give off, close to the vertebræ, muscular branches to the longus colli muscle, and the fourth nerve occasionally gives off a muscular filament to the upper part of the scalenus anticus.

The Rami Communicantes Hypoglossi.—These nerves arise from the second and third cervical nerves, and descend either in front of or behind the internal jugular vein, to unite with the descendens hypoglossi to form the ansa hypoglossi.

The Phrenic Nerve.—The phrenic nerve arises mainly from the anterior primary division of the fourth cervical nerve, with additional filaments from either the third or the fifth nerves.

The phrenic nerve descends in front of the scalenus anticus muscle, which it crosses obliquely from without inwards, the obliquity being more marked on the left side than on the right. In its descent through the neck the phrenic nerve lies behind the posterior belly of the omo-hyoid muscle, the transverse cervical and supra-scapular arteries, and on the left side, behind the thoracic duct. It passes through the thorax to supply the diaphragm.

The External Series of Deep Branches.—The external series of deep branches are as follows:—

Communicating.

Muscular.

Communicating Branches.—Communications are established with the spinal accessory nerve in three situations—(a) in the substance of the sterno-mastoid muscle, (b) on

the deep surface of the trapezius, and (c) in the posterior triangle.

(a) In the substance of the *sterno-mastoid*, communications are established between the spinal accessory nerve and the filaments from the second cervical nerve, which assist in the nervous supply of that muscle.

(b) On the deep surface of the *trapezius* muscle communications are established between the spinal accessory nerve and the filaments from the third and fourth cervical nerves, which assist in the nervous supply of the trapezius.

(c) In the *posterior triangle* communications are established between the spinal accessory nerve and the branches from the third and fourth cervical nerves.

Muscular Branches.—Muscular branches are given off as follows:—

To the sterno-mastoid from the second cervical nerve.

To the trapezius

To the levator anguli scapulæ

To the scalenus medius

} from the third and fourth
cervical nerves.

The Rectus Capitis Lateralis Muscle.—*Origin.*—From the upper and anterior part of the transverse process of the atlas.

Insertion.—Into the inferior surface of the jugular process of the occipital bone.

Nerve Supply.—The nerve loop between the anterior primary divisions of the first and second cervical nerves.

Action.—A lateral flexor of the head at the occipito-atlantal articulation.

IX. THE INTERIOR OF THE CRANIUM

Dissection. — The skull cap, or calvarium, must be taken off by means of the saw and chisel, and the brain removed. The various processes of the dura mater, the venous sinuses, and parts of the cranial nerves are to be left *in situ*.

The Meninges of the Brain.—The meninges, or the coverings of the brain, are three in number, as follows:—

An external fibrous membrane, the *dura mater*, which

lines the interior of the skull, and forms a loose sheath for the spinal cord.

An intermediate non-vascular membrane, the *arachnoid mater*.

An internal areolar and vascular layer, the *pia mater*, which closely invests the brain and cord.

Of these three membranes the only one now requiring description is the dura mater, as in the interior of the skull it forms certain folds which are best studied now. The other two layers are considered with the brain itself.

The Dura Mater.—The dura mater is the most external of the three coverings of the brain and cord. It is a strong, fibrous layer, which forms an internal periosteum for the bones of the skull, and supports the cerebral hemispheres.

The *external* surface of the dura mater is rough, and between this surface of the dura and the bone the various meningeal arteries ramify. Near the middle line of the skull there are certain granular masses termed the *Pacchionian bodies*.

The *internal* surface of the dura mater is smooth and free, and is separated from the arachnoid mater by a space termed the *subdural space*. The dura sends processes outwards with the various cranial nerves.

The fibrous tissue of which the dura mater is composed is divisible into two layers, which are separated at certain places by venous channels, termed *sinuses*.

The innermost of these two layers further sends in processes between the various parts of the brain. These processes are three in number, as follows:—

The falx cerebri.

The falx cerebelli.

The tentorium cerebelli.

The Falx Cerebri.—The falx cerebri is the median sickle-shaped process of dura mater which dips downwards between the two cerebral hemispheres. It is narrow in front, where it is attached to the crista galli of the ethmoid bone, and broad behind, where it is attached to the middle of the upper surface of the tentorium cerebelli.

Along its *upper convex border*, where it is attached to the middle line of the calvarium, there is the superior longitudinal sinus.

Its *lower concave border* is free, and is turned towards the corpus callosum with which it is in contact posteriorly. In this border is the inferior longitudinal sinus.

Along the tentorial border of the falx cerebri there is the straight sinus.

The Falx Cerebelli.—The falx cerebelli is a somewhat triangular fold of dura mater, which lies below the tentorium cerebelli, and projects forwards between the two cerebellar hemispheres.

The *base* of the falx cerebelli is uppermost, and is attached to the inferior surface of the tentorium cerebelli.

The *apex* extends to the foramen magnum.

The *posterior* border is attached to the internal occipital crest, and contains the occipital sinus.

The *anterior* border is free.

The Tentorium Cerebelli.—The tentorium cerebelli is somewhat horizontally situated between the posterior part of the cerebrum and the cerebellum. It presents for examination a superior and an inferior surface, and an internal and an external border.

The *superior surface* is convex, elevated in the middle, and slopes downwards in all directions towards its external circumferential attachment. It is in contact with the posterior part of the cerebrum, and in the middle line the falx cerebri is attached to it, the straight sinus running backwards along the junction of the two processes.

The *inferior surface* is concave, and is in contact with the superior surfaces of the cerebellar hemispheres.

The *internal border* is concave, and is free except at its anterior extremities, where it is attached to the anterior clinoid processes of the sphenoid bone. This border forms, along with the dorsum sellæ of the sphenoid, an oval opening within which the mesencephalon or mid-brain is placed.

The *external border* or the circumferential attachment is convex, and is successively attached to the occipital bone

along the groove for the lateral sinus, to the posterior inferior angle of the parietal, to the superior border of the petrous portion of the temporal, and to the posterior clinoid process of the sphenoid. In this border there are two sinuses—the superior petrosal sinus in its anterior half, and part of the lateral sinus in its posterior half.

The Venous Sinuses.—The venous sinuses are certain intracranial channels for venous blood which lie between the two layers of the dura mater.

They may be divided into two groups—those which are paired, and those which are single.

The paired sinuses—

The two lateral sinuses.

The two superior petrosal sinuses.

The two inferior petrosal sinuses.

The two cavernous sinuses.

The two intercavernous sinuses.

The single sinuses—

The superior longitudinal sinus.

The inferior longitudinal sinus.

The straight sinus.

The occipital sinus.

The basilar sinus.

The Lateral Sinuses.—The lateral sinuses commence at the internal occipital protuberance—that of the right side as a direct continuation of the superior longitudinal sinus, that of the left as a direct continuation of the straight sinus. There is usually a communication between the two lateral sinuses at the internal occipital protuberance, forming what is termed the *torcular Herophili*.

Each lateral sinus passes outwards and forwards, and then downwards, forwards, and inwards, grooving successively the occipital, parietal, temporal, and occipital bones, until it reaches the posterior compartment of the jugular foramen, through which it passes, to terminate by becoming the internal jugular vein.

Tributaries.—The tributaries of the lateral sinus are small cerebral and cerebellar veins, the superior petrosal sinus, and communications with the occipital veins and deep veins of

the neck, by means of emissary veins which pass through the mastoid and posterior condylar foramina.

The Superior Petrosal Sinuses.—Each superior petrosal sinus commences at the posterior part of the cavernous sinus on the body of the sphenoid bone, and runs outwards and backwards in the attached edge of the tentorium cerebelli along the superior border of the petrous portion of the temporal bone, to terminate in the lateral sinus.

The Inferior Petrosal Sinuses.—Each inferior petrosal sinus commences in the cavernous sinus, and runs outwards and downwards in the groove between the petrous temporal and the basi-occiput to the anterior compartment of the jugular foramen, through which it passes, to terminate in the internal jugular vein, just below the base of the skull.

The Cavernous Sinuses.—The two cavernous sinuses are situated one on either side of the body of the sphenoid bone, and extend from the inner end of the sphenoidal fissure to the apex of the petrous temporal.

Opening into the cavernous sinus *anteriorly* are the ophthalmic veins, which pass backwards from the orbit through the sphenoidal fissure to terminate in the cavernous sinus, whilst opening out of the cavernous sinus *posteriorly* are the two petrosal sinuses.

Each cavernous sinus communicates with its fellow by means of the intercavernous sinuses, and with the pterygoid venous plexus outside the skull by means of small veins which pass through the foramen ovale.

Passing horizontally forwards through the outer wall of the cavernous sinus are the third, fourth, ophthalmic division of the fifth and the sixth cranial nerves.

The horizontal portion of the third or intracranial part of the internal carotid artery passes through the sinus, only separated from the venous blood contained within the sinus by a thin lining membrane.

The Intercavernous Sinuses.—The intercavernous sinuses pass transversely across the sella turcica between the right and left cavernous sinuses, one being in front of, the other behind, the pituitary body. The name "*circular sinus*" is sometimes applied to the venous ring thus formed.

The Superior Longitudinal Sinus.—The superior longitudinal sinus commences at the crista galli of the ethmoid bone, and not infrequently communicates there with the veins of the nasal fossæ through the foramen cæcum.

It runs backwards along the superior convex border of the falx cerebri, to terminate at the internal occipital protuberance by becoming directly continuous with the right lateral sinus.

The interior of this sinus is somewhat triangular in form, and is much larger behind than in front. It is crossed by numerous small bands which are termed the *chordæ Willisii*.

Tributaries.—The superior longitudinal sinus receives the superior cerebral veins, which pass into it from behind forwards, that is, in a direction contrary to the blood flow through the sinus.

The Inferior Longitudinal Sinus.—The inferior longitudinal sinus is very small. It passes backwards along the posterior half of the inferior concave border of the falx cerebri, to terminate posteriorly, at the middle of the free concave margin of the tentorium cerebelli, by uniting with the straight sinus.

The Straight Sinus.—This sinus commences in the veins of Galen in the interior of the brain. It passes backwards and downwards in the mesial plane, along the tentorial border of the falx cerebri, to terminate at the internal occipital protuberance by becoming directly continuous with the left lateral sinus.

Tributaries.—The straight sinus is joined by the veins of Galen which form it, by the inferior longitudinal sinus, and by some small cerebellar veins.

The Occipital Sinus.—This is a small sinus situated in the posterior border of the falx cerebelli. It extends from the torcular Herophili to the foramen magnum, where it communicates with the posterior spinal veins.

The Basilar Sinus.—This is rather a venous plexus, situated over the basi-occiput, and communicating with the inferior petrosal sinuses and with the anterior spinal veins.

The Meningeal Arteries.—The meningeal arteries are intended for the supply of the dura mater and the bones of

the skull. They are named anterior, middle, and posterior, according to the cerebral fossa in which they ramify. These vessels, with their origins and places of entrance in the cranial cavity, may be classified as follows:—

1. Anterior meningeal.	Anterior ethmoidal artery.	Anterior ethmoidal foramen.
2. Middle meningeal.	(a) Small. Large middle meningeal artery.	Foramen ovale.
	(b) Large. Internal maxillary artery.	Foramen spinosum.
	(c) Third. Ascending pharyngeal.	Carotid canal.
3. Posterior meningeal.	(a) Ascending pharyngeal.	Anterior condylar foramen.
	(b) Vertebral.	Foramen magnum.
	(c) Occipital.	Jugular foramen.

The Anterior Meningeal Arteries.—These vessels are derived from the anterior ethmoidal artery, a branch of the ophthalmic artery within the orbit. They enter the skull through the anterior ethmoidal foramen, and supply the dura mater over and near the ethmoid bone.

The Middle Meningeal Arteries.—The middle meningeal arteries are three in number,—small, large, and third.

(a) *The Small Middle Meningeal Artery.*—This vessel usually arises from the large middle meningeal artery in the pterygo-maxillary region. It enters the cranial cavity through the foramen ovale, and supplies the Gasserian ganglion and the dura mater in the middle cerebral fossa.

(b) *The Large Middle Meningeal Artery.*—The large middle meningeal artery is a branch of the first part of the internal maxillary. It enters the cranial cavity through the foramen spinosum and divides into two branches.

The *anterior* and larger branch runs upwards in the deep groove on the anterior inferior angle of the parietal bone, and supplies the dura mater as high upwards as the sagittal suture, and also sends branches forwards to the frontal bone.

The *posterior* and smaller branch supplies the dura mater over the parietal bone and part of the occipital bone, and the bones themselves.

Branches.—The large middle meningeal artery gives off several branches, which may be classified as follows:—

Extra-cranial branch—

The small middle meningeal artery.

Intra-cranial branches—

Branches to the Gasserian ganglion and dura mater.

Petrosal branch.

Tympanic branches.

Orbital branch.

The *petrosal* branch enters the hiatus Fallopii, and anastomoses with the stylo-mastoid branch from the posterior auricular artery.

The *tympanic* branches enter the tympanum through the petro-squamous fissure.

The *orbital* branch sometimes arises from the anterior division of the large middle meningeal instead of from the main trunk. It passes to the outer end of the sphenoidal fissure, and communicates with the lachrymal branch from the ophthalmic.

(c) *The Third Middle Meningeal Artery.*—This is a very minute vessel which, when present, arises from the ascending pharyngeal, and enters the middle cerebral fossa through the carotid canal.

The Posterior Meningeal Arteries.—The posterior meningeal arteries are derived from three sources.

(a) *From the Ascending Pharyngeal Artery.*—Small meningeal branches from the ascending pharyngeal artery enter the posterior cerebral fossa through the anterior condylar foramen, and sometimes through the jugular fossa in addition.

(b) *From the Vertebral Artery.*—Small meningeal branches are occasionally given off by the vertebral artery. When present they enter the posterior cerebral fossa through the foramen magnum.

(c) *From the Occipital Artery.*—The occipital artery occasionally gives off meningeal branches, which enter the posterior cerebral fossa through the jugular foramen.

The Large Middle Meningeal Veins.—Two veins accompany the large middle meningeal artery, and terminate below in a common trunk which opens into the pterygoid venous plexus.

The Meningeal Nerves.—Minute meningeal nerves for the supply of the dura mater are derived from the fifth, tenth, and twelfth cranial nerves, and from the sympathetic.

The Cranial Nerves.—The cranial nerves are twelve in number. In connection with each nerve there are four points to be studied:—

The deep origin of the nerve.

The superficial origin of the nerve.

The point at which the nerve pierces the dura mater.

The point at which the nerve leaves the skull.

Of these four points, the first two are described with the brain. Here, the third and fourth points are alone described.

1. The Olfactory Nerves.—The olfactory nerves are about twenty small filaments which spring from the olfactory bulb. They pierce the dura mater and bone at the same place, that is, in the foramina in the cribriform plate of the ethmoid on either side of the crista galli, and descend to the nose.

2. The Optic Nerve.—The optic nerve pierces the dura mater and bone at the same place—the optic foramen. The ophthalmic artery also passes through the optic foramen, lying immediately below the nerve.

3. The Oculo-Motor Nerve.—The oculo-motor nerve pierces the dura mater opposite the posterior clinoid process. Each nerve then runs forwards embedded in the outer wall of the cavernous sinus, and, leaving the skull, enters the orbit through the sphenoidal fissure.

The oculo-motor nerve supplies all the muscles of the orbit except the superior oblique and external rectus muscles, and by means of its connection with the ciliary ganglion it also supplies the sphincter muscle of the iris and the ciliary muscle of the eyeball.

4. The Trochlear or Patheticus Nerve.—The trochlear or patheticus nerve pierces the dura mater in the free edge of the tentorium cerebelli, just behind the posterior clinoid process. Passing forwards through the outer wall of the cavernous sinus, the nerve leaves the skull and enters the orbit through the inner end of the sphenoidal fissure, and supplies one muscle of the orbit, the superior oblique.

5. The Trigeminal Nerve.—The trifacial or trigeminal

nerve resembles a spinal nerve in two respects. It arises by two roots—one motor, and the other sensory; and, secondly, the sensory root has a ganglion upon it—the Gasserian ganglion. The sensory and motor roots pierce the dura mater over the apex of the petrous temporal, and to see the remaining part of the nerve both the Gasserian ganglion and the dura mater must be removed.

The *large sensory root*, having pierced the dura mater at the place indicated, enters the middle cerebral fossa, and at once passes into the Gasserian ganglion.

The *small motor root* lies to the inner side of and below the sensory root. It passes outwards below the Gasserian ganglion without communicating in any way with it, and, leaving the skull through the foramen ovale, throws all its fibres into the third or inferior maxillary division of the fifth nerve.

The *Gasserian ganglion* is situated in a depression at the apex of the petrous temporal, and is enclosed in a recess formed by a splitting of the dura mater, which is termed the *cavum Meckelii*. It is somewhat flattened and crescentic in form, the convexity being forwards.

From the anterior part of the Gasserian ganglion proceed the three divisions into which the fifth nerve breaks up, as follows:—

The first or ophthalmic division, purely sensory.

The second or superior maxillary division, purely sensory.

The third or inferior maxillary division, both motor and sensory.

The *ophthalmic* division passes forwards in the outer wall of the cavernous sinus, and, leaving the skull through the sphenoidal fissure, enters the orbit, where it breaks up into lachrymal, frontal, and nasal nerves.

The *superior maxillary* division leaves the skull through the foramen rotundum, and, entering the sphenomaxillary fossa, is continued onwards to the face as the infra-orbital nerve.

The *inferior maxillary* division leaves the skull through the foramen ovale, and enters the pterygo-maxillary region.

It contains all the motor fibres from the motor root, and is therefore a mixed nerve.

6. The Abducent Nerve.—The abducent nerve pierces the dura mater behind the body of the sphenoid bone to the inner side of, and slightly below, the fifth nerve. Passing forwards through the cavernous sinus it leaves the skull through the sphenoidal fissure, and, entering the orbit, supplies the external rectus.

7. The Facial Nerve.—The facial nerve pierces the dura mater and disappears from the interior of the skull at the same place—the internal auditory meatus.

The facial nerve is the great motor nerve for all superficial muscles of the head. It supplies the muscles of expression, and some of its branches form the motor nerves for both the anterior and posterior halves of the scalp.

8. The Auditory Nerve.—Like the facial nerve, this nerve pierces dura mater and bone at the internal auditory meatus. In this meatus the auditory nerve lies below the facial nerve and is the larger of the two. At the bottom of the meatus the two nerves part company; the facial nerve runs through the aqueduct of Fallopius to the face, and the auditory nerve proceeds to the internal ear.

9. The Glosso-Pharyngeal Nerve.

10. The Pneumogastric or Vagus Nerve.

11. The Spinal Accessory Nerve.

These three nerves all pierce the dura mater and escape from the skull at the same place—the middle compartment of the jugular foramen. The glosso-pharyngeal nerve is external to the other two.

12. The Hypoglossal Nerve.—The hypoglossal nerve pierces the dura mater and escapes from the skull at the anterior condylar foramen, frequently in two pieces.

The hypoglossal nerve is the great motor nerve for the tongue. It also supplies the depressor muscles of the hyoid bone, and one of the elevators, namely, the genio-hyoid muscle.

All the cranial nerves, with the exception of the third, fourth, fifth, and sixth, pierce dura mater and bone at the same place.

Of the various cranial nerves, the first, second, and eighth are nerves of *special sense*.

The third, fourth, sixth, seventh, eleventh, and twelfth are *motor* nerves.

The fifth, ninth, and tenth are *mixed* nerves.

The Third or Intra-Cranial Part of the Internal Carotid Artery.—The internal carotid artery, having gained the interior of the skull through the carotid canal, first passes horizontally forwards through the substance of the cavernous sinus, and then, turning upwards, terminates on the inner side of the anterior clinoid process, by dividing into anterior and middle cerebral arteries.

Whilst passing *forwards* through the cavernous sinus the artery has the third, fourth, ophthalmic division of the fifth, and the sixth cranial nerves to its outer side.

Whilst passing *upwards* to its termination the vessel ascends between the second and third cranial nerves to the anterior perforated space of the brain.

Branches.—The branches of the third part of the internal carotid artery are as follows:—

Within the cavernous sinus—

Branches to the dura mater.

Branches to the pituitary body.

Branches to the nerves in the outer wall of the cavernous sinus.

Branches to the Gasserian ganglion.

Without the cavernous sinus—

The ophthalmic artery.

The posterior communicating artery.

The anterior choroid artery.

The terminal branches—

(a) Anterior cerebral.

(b) Posterior cerebral.

The Vertebral Artery.—The vertebral artery leaves the suboccipital triangle by passing forwards below the posterior occipito-atlantal ligament, and piercing the dura mater and arachnoid, it turns upwards and forwards in the subarachnoid space, and enters the skull through the foramen magnum.

Within the cranial cavity the two vertebral arteries

incline inwards from the sides to the front of the medulla oblongata, and unite, at the lower border of the pons varolii, to form the *basilar artery*.

Intra-Cranial Branches.—The intra-cranial branches of the vertebral artery are as follows:—

The posterior spinal artery.

The posterior inferior cerebellar artery.

The anterior spinal artery.

Bulbar branches.

The basilar artery formed by the junction of the two
vertebrals.

These vessels supply the brain and spinal cord, and are considered with those structures.

The Great Superficial Petrosal Nerve.—This nerve is a branch from the intra-petrous portion of the facial nerve. It emerges from the interior of the petrous temporal and enters the cranial cavity at the hiatus Fallopii. The nerve then passes forwards and inwards below the Gasserian ganglion and along the outer side of the second part of the internal carotid artery, to unite with the great deep petrosal nerve from the carotid plexus to form the Vidian nerve, which passes to Meckel's ganglion.

X. THE ORBIT

Definition.—The orbit is an irregularly quadrilateral fossa, lying on its side, with the base directed forwards and slightly outwards.

The inner walls of each orbit are straight and nearly parallel with each other.

The outer walls diverge in such a way that they almost form a right angle with one another.

Description.—Each orbit presents for examination a base, an apex, and four walls.

The Base.—The base looks forwards towards the face, and is somewhat quadrilateral, with the angles slightly rounded off. It is bounded *above* by the external angular process, the orbital arch, and the internal angular process; *below*, by the superior maxilla and malar bones.

The Apex.—The apex of the orbit is formed by the optic foramen.

The Roof.—The roof of the orbit is formed by two bones—the orbital plate of the frontal and the lesser wing of the sphenoid.

The Outer Wall.—The outer wall of the orbit is formed by two bones—the malar and the greater wing of the sphenoid.

The Floor.—The floor of the orbit is formed by three bones—the malar bone, the orbital surface of the superior maxilla, and by the orbital process of the palate.

The Internal Wall.—The internal wall of the orbit is formed by the nasal process of the superior maxilla, the lachrymal, the os planum of the ethmoid bone, and by the body of the sphenoid.

Contents.—The contents of the orbit are numerous, and are as follows:—

Vessels.—The ophthalmic artery and its branches, and the corresponding veins.

Muscles.—The muscles are seven in number, as follows:—

The levator palpebræ superioris.

The superior rectus.

The inferior rectus.

The internal rectus.

The external rectus.

The superior oblique.

The inferior oblique.

Nerves.—The various nerves found in the orbit may be classified according to their function thus:—

Motor nerves—

The third or oculo-motor.

The fourth or trochlear.

The sixth or abducent.

Sensory—

The ophthalmic division of the fifth or trigeminal.

(a) Lachrymal.

(b) Frontal.

(c) Nasal.

The orbital branch from the superior maxillary division of the fifth.

Special Sense—

The second or optic.

Other Structures.—The eyeball; the lachrymal gland, with which may be associated the lachrymal apparatus; the lenticular or ciliary ganglion; the capsule of Tenon, and some fat.

The Periosteum.—The periosteum, which lines the interior of the orbital cavity, is continuous through the sphenoidal fissure with the dura mater. In front it becomes continuous with the periosteum on the outer side of the skull.

The Sensory Nerves of the Orbit.—The sensory nerves in the orbit are all derived from the fifth cranial nerve, as follows:—

From the ophthalmic division—

The lachrymal nerve.

The frontal nerve.

The nasal nerve.

From the superior maxillary division—

The orbital nerve.

The Ophthalmic Division of the Fifth Cranial Nerve.

—The ophthalmic division of the fifth cranial nerve is about one inch in length. It passes from the Gasserian ganglion, forwards and upwards in the outer wall of the cavernous sinus, to the inner end of the sphenoidal fissure, where it terminates by breaking up into its three terminal branches—lachrymal, frontal, and nasal.

The Lachrymal Nerve.—The lachrymal nerve passes forwards along the outer wall of the orbit, immediately above the external rectus muscle, to the lachrymal gland which it supplies.

This nerve also gives off palpebral branches to the eyelids, and to the skin of the face in the neighbourhood of the external angular process.

The Frontal Nerve.—The frontal nerve, the largest of the three terminal branches of the ophthalmic division of the fifth nerve, passes forwards between the periosteum and the levator palpebræ superioris muscle to about the middle of the orbit, where it terminates by breaking up into the supra-orbital and supra-trochlear nerves, which supply the skin of the scalp.

The Nasal Nerve.—The nasal nerve enters the orbit between the two heads of the external rectus muscle, and between the two divisions of the third or oculo-motor nerve. It passes forwards and inwards above the optic nerve, but below the superior rectus and superior oblique muscles, to the inner wall of the orbit. The nasal nerve leaves the orbit and enters the cranial cavity through the anterior ethmoidal foramen.

Having reached the cranial cavity, the nasal nerve passes forwards along the outer edge of the cribriform plate of the ethmoid, to the most anterior part of that bone, where it leaves the cranial cavity and enters the nasal fossa through a small foramen situated between the ethmoid and frontal bones.

In the nasal fossa the nerve descends in a groove on the posterior surface of the nasal bone, and terminates on the face as one of the sensory nerves of that region.

Branches.—The branches of the nasal nerve may be classified as follows:—

Branches within the orbit—

The branch to the ciliary ganglion.

The long ciliary nerves.

The infra-trochlear nerve.

Branches within the nasal fossa—

The internal nasal or septal branch.

The external nasal branch.

Branches upon the face—

Terminal branches to the skin.

The Branch to the Ciliary Ganglion.—This branch arises from the nasal nerve between the two heads of the external rectus muscle; it passes forwards on the outer side of the optic nerve to the upper and back part of the ciliary ganglion, forming the long or sensory root of that structure.

The Long Ciliary Nerves.—These nerves—usually two in number—arise from the nasal nerve on the inner side of the optic nerve, and pierce the sclerotic coat of the eyeball.

The Infra-Trochlear Nerve.—This nerve passes forwards along the inner wall of the orbit, below the superior oblique muscle, to supply the skin of the face near the inner canthus.

The Internal Nasal or Septal Branch.—This branch supplies the nasal mucous membrane over the anterior part of the septum nasi almost as far downwards as the anterior nares.

The External Nasal Branch.—The external branch supplies the nasal mucous membrane over the anterior part of the outer wall of the nasal fossæ, usually including the anterior extremities of both the middle and inferior turbinate bones. The two nasal branches of the nasal nerve are nerves of ordinary sensation to the mucous membrane of the nose.

The Orbital Branch of the Superior Maxillary Division of the Fifth Cranial Nerve.—The orbital nerve arises from the superior maxillary division of the fifth within the spheno-maxillary fossa. It enters the orbit through the spheno-maxillary fissure, and almost immediately divides into two branches, temporal and malar.

The Temporal Branch.—The temporal branch runs upwards in the outer wall of the orbit, and leaves that cavity through the temporal canal in the malar bone. The nerve then passes upwards in the temporal fossa between the bone and the temporal muscle, and, eventually piercing the muscle and the temporal fascia, becomes a cutaneous nerve of the scalp.

The Malar Branch.—The malar branch runs forwards along the lower and outer angle of the orbit, and reaches the face through the malar canal in the malar bone. It becomes a cutaneous nerve of the face.

The Ophthalmic Artery.—The ophthalmic artery is a branch of the third part of the internal carotid artery. It arises from that vessel on the inner side of the anterior clinoid process, and enters the orbit through the optic foramen, immediately below the optic nerve.

Having entered the orbit, the artery passes forwards on the outer side of the optic nerve, and then turns inwards above the nerve, to the inner wall of the orbit. The artery then passes forwards between the superior oblique and internal rectus muscles, to the internal angular process, where it terminates by dividing into its two terminal branches, the nasal and frontal arteries.

Branches.—The branches of the ophthalmic artery are numerous and small. They are as follows:—

The central artery of the retina.

The ciliary arteries—

Posterior ciliary arteries.

Anterior ciliary arteries.

The lachrymal artery.

Muscular branches.

The supra-orbital artery.

The anterior and posterior ethmoidal arteries.

The superior and inferior palpebral arteries.

The nasal artery.

The frontal artery.

The Central Artery of the Retina.—This small vessel arises close to the optic foramen. It pierces the lower and outer part of the optic nerve half an inch behind the eyeball, and passes forwards to the retina in the substance of the nerve.

The Ciliary Arteries.—These vessels are divided into two groups—posterior and anterior ciliary arteries.

The *posterior* ciliary arteries arise by two principal trunks, one on either side of the optic nerve, and while the ophthalmic artery is lying below the optic nerve. Each trunk divides into numerous branches, which pierce the sclerotic coat near the entrance of the optic nerve and supply the choroid coat of the eye. As two of these vessels are much longer than the others, the posterior ciliary vessels are further divided into *long* and *short* posterior ciliary arteries.

The *anterior* ciliary arteries, some six or eight in number, are irregular in their origin. They pierce the sclerotic close to the corneo-sclerotic junction.

The Lachrymal Artery.—This vessel arises from the ophthalmic artery on the outer side of the optic nerve. It passes forwards on the outer side of the orbit with the nerve of the same name, and, after supplying the lachrymal gland, gives off the external palpebral arteries.

Muscular Branches.—Muscular branches are given off irregularly to the muscles of the orbit.

The Supra-Orbital Artery.—This artery arises from the

ophthalmic artery, whilst that vessel is crossing the optic nerve. It passes forwards on the inner side of the levator palpebræ superioris and superior rectus muscles, until it reaches the supra-orbital notch, through which it passes, to terminate on the forehead.

The Anterior and Posterior Ethmoidal Arteries.—These small vessels pass through the foramina of the same names on the inner wall of the orbit, to be distributed to the ethmoidal air cells, the nasal fossæ, and the meninges of the brain.

The Superior and Inferior Palpebral Arteries.—These small vessels arise near the anterior part of the orbit, and pass outwards into the upper and lower eyelids, where they anastomose with the palpebral branches from the lachrymal artery.

The Nasal Artery.—This vessel passes forwards above the internal tarsal ligament to the root of the nose, where it anastomoses with the angular branch of the facial artery.

The Frontal Artery.—This vessel accompanies the supra-trochlear nerve, to be distributed to the inner part of the forehead.

The Ophthalmic Veins.—The ophthalmic veins are two in number—superior and inferior. They both pass backwards between the two heads of the external rectus muscle, and through the sphenoidal fissure, to terminate in the cavernous sinus.

The *superior ophthalmic vein* commences in front by a communication with the angular vein, and accompanies the ophthalmic artery across the optic nerve.

The *inferior ophthalmic vein* passes backwards below the optic nerve. It communicates through the speno-maxillary fissure with the pterygoid venous plexus.

Tributaries.—The tributaries of the ophthalmic veins correspond to the branches of the artery, with the exceptions of the supra-orbital, frontal, and palpebral veins, which do *not* join the ophthalmic veins, but pass forwards out of the orbit to join the veins of the face.

The Muscles of the Orbit.—The muscles of the orbit are seven in number—the four recti, the two obliques, and the levator palpebræ superioris.

All these muscles are supplied by the third cranial nerve,

with the exceptions of the superior oblique which is supplied by the fourth cranial nerve, and the external rectus which is supplied by the sixth cranial nerve.

The Levator Palpebræ Superioris Muscle.—This muscle passes from the orbit to the upper eyelid. It is the most superficial muscle of the orbit.

Origin.—By a pointed tendinous process, just above and in front of the optic foramen, from which it is separated by the origin of the superior rectus.

Insertion.—By a broad membranous expansion into the upper eyelid. As this expansion reaches the upper eyelid it divides into three portions.

The most *anterior* of these blends with the superior palpebral ligament, and passes forwards above the tarsus of the upper eyelid to the deep surface of the palpebral portion of the orbicularis palpebrarum muscle.

The *intermediate* stratum is inserted into the upper border of the tarsus of the upper eyelid, and the most *posterior* portion into the fornix of the conjunctiva.

Nerve Supply.—The upper division of the third or oculo-motor nerve.

Action.—A simple elevator of the upper eyelid, the muscle antagonising the upper palpebral part of the orbicularis palpebrarum muscle.

Relations.—The *upper* surface of the muscle is in contact with the frontal nerve and with the periosteum of the orbit.

The *lower* surface is in contact with the superior rectus muscle.

The Four Recti Muscles.—The recti muscles are four in number—superior and inferior, internal and external.

Origin.—The four recti muscles arise from an oval tendinous ring which passes downwards on the inner side of the optic foramen, and then stretches transversely across the inner part of the sphenoidal fissure to be attached to a small osseous spicule on its lower border, and thence upwards to the upper part of the optic foramen.

The *external rectus* differs from the other recti in having two heads of origin, the lower and larger of which arises

from the osseous spicule just referred to, and the upper from the common ring of origin just above the optic foramen.

Insertion.—The four recti pass forwards to be inserted into the sclerotic coat of the eyeball about quarter of an inch external to the corneo-sclerotic junction.

Nerve Supplies.—The external rectus is supplied by the sixth cranial nerve.

The superior rectus is supplied by the upper division of the third cranial nerve.

The inferior and internal recti by the lower division of the same nerve.

Action.—The internal and external recti simply rotate the eyeball inwards and outwards respectively.

The upper and lower recti draw the eyeball upwards and inwards, and downwards and inwards respectively. This tendency of the upper and lower recti to displace the eyeball inwards must be noted particularly.

Relations.—Between the two heads of the external rectus certain structures pass forwards into the orbit. These are the third, the nasal branch of the fifth, and the sixth cranial nerves, whilst the ophthalmic veins pass backwards between the two heads.

The Superior Oblique Muscle.—This is a narrow elongated muscle, placed at the upper and inner part of the orbit, just internal to the levator palpebræ superioris.

Origin.—From the upper and inner part of the optic foramen.

Insertion.—The muscle passes forwards towards the inner canthus of the eye, until it reaches a fibro-cartilaginous ring termed the *trochlea or pulley*. Passing through this trochlea, the tendon of the superior oblique changes its direction altogether, and passing outwards, downwards, and backwards between the eyeball and the superior rectus, is inserted into the sclerotic behind the middle of the eyeball and between the superior and external recti muscles.

Nerve Supply.—The fourth cranial nerve, which enters the muscle on its upper or orbital surface.

Action.—This muscle rotates the eyeball downwards and outwards.

Relations.—The *upper* surface of the superior oblique is in contact with the roof of the orbit, the fourth cranial nerve entering this surface to supply the muscle.

The *inferior* surface rests upon the nasal nerve, the ophthalmic artery, and the internal rectus muscle.

The Inferior Oblique Muscle.—This muscle, unlike all the other muscles, passes much more nearly transversely across the orbital cavity.

Origin.—From a small depression on the orbital surface of the superior maxilla, just external to the orifice of the nasal duct.

Insertion.—The muscle passes backwards, outwards, and upwards—firstly, between the inferior rectus and the floor of the orbit; and, secondly, between the external rectus and the eyeball,—to be inserted into the sclerotic behind the middle of the eyeball, and between the superior and external recti muscles.

Nerve Supply.—The lower division of the third or oculo-motor nerve.

Action.—This muscle rotates the eyeball upwards and outwards.

The Motor Nerves of the Orbit.—The motor nerves of the orbit are three in number, as follows:—

The oculo-motor or third cranial nerve.

(a) Upper division—

The levator palpebræ superioris.

The superior rectus.

(b) Lower division—

The internal rectus.

The inferior rectus.

The inferior oblique.

The patheticus or fourth cranial nerve.

The superior oblique.

The abducent or sixth cranial nerve.

The external rectus.

The Third or the Oculo-Motor Nerve.—At the inner end of the sphenoidal fissure the third cranial nerve breaks up into two divisions, upper and lower. Both these divisions enter the orbit through the inner end of the sphenoidal

fissure, and between the two heads of the external rectus muscle, where they are separated from each other by the nasal nerve.

The *upper* division passes inwards above the optic nerve, to supply the levator palpebræ superioris and superior rectus muscles.

The *lower* division supplies the internal rectus, the inferior rectus, and the inferior oblique muscles. The nerve to the inferior oblique muscle passes forwards between the external and inferior recti muscles, and gives off the short or motor root to the ciliary ganglion.

The Fourth or the Trochlear Nerve.—This small nerve enters the orbit through the inner end of the sphenoidal fissure above the external rectus muscle. It passes inwards above the origins of the levator palpebræ superioris and superior rectus muscles, to terminate in the orbital or superior surface of the superior oblique muscle, which it supplies.

The Sixth or the Abducent Nerve.—This nerve enters the orbit through the inner end of the sphenoidal fissure, and between the two heads of the external rectus muscle, supplying that muscle on its inner or ocular surface.

The Ciliary or Lenticular Ganglion.—The ciliary or lenticular ganglion is a small reddish body, flattened from side to side and somewhat quadrilateral, which is situated at the back of the orbit, between the external rectus and the optic nerve. It serves as a centre for the supply of the various nerves to the eyeball.

The Roots of the Ciliary Ganglion.—The roots of the ciliary ganglion are as follows:—

The *motor* root or the short root of the ganglion is derived from the nerve to the inferior oblique, from the lower division of the third or oculo-motor nerve. It passes upwards to the lower posterior angle of the ganglion.

The *sensory* or long ciliary root is derived from the nasal nerve, and joins the upper and posterior angle of the ganglion.

The *sympathetic* or middle root is derived from the cavernous plexus of the sympathetic.

The Branches of Distribution of the Ciliary Ganglion.—The

branches of distribution of the ciliary ganglion are the *short ciliary nerves*. These are six or eight in number, and they pass from the anterior part of the ganglion, dividing as they pass to the eyeball. They thus form eventually about twelve to twenty filaments, which are arranged in two groups—an upper group above the optic nerve, and a lower group below that nerve. They pierce the sclerotic close to the optic nerve.

The Optic Nerve.—The second or optic nerve constitutes the nerve for the special sense of sight. It enters the orbit through the optic foramen, and above the ophthalmic artery. It passes forwards, outwards, and slightly downwards, to enter the posterior part of the eyeball, immediately internal to its centre.

Within the orbit the optic nerve is surrounded by the recti muscles, and afterwards by the ciliary vessels and nerves. Its upper surface is crossed by the ophthalmic artery, the superior ophthalmic vein, and the nasal nerve.

Arrangement of the Nerves in the Sphenoidal Fissure.—The arrangement of the nerves in the sphenoidal fissure differs slightly from that in the outer wall of the cavernous sinus.

In the outer wall of the *cavernous sinus* the third, fourth, ophthalmic division of the fifth, and the sixth cranial nerves are arranged in their numerical order from above downwards.

In the *sphenoidal fissure* the third cranial nerve breaks up into its upper and lower divisions, and the ophthalmic division of the fifth breaks up into its three terminal branches,—lachrymal, frontal, and nasal. The order of these various nerves in the sphenoidal fissure is as follows:—

(a) The highest nerves in the sphenoidal fissure all occupy the same horizontal plane. They are, from without inwards:—

1. The lachrymal nerve resting upon the external rectus muscle.
2. The frontal nerve resting upon the levator palpebræ superioris muscle.
3. The fourth cranial nerve resting upon the posterior end of the superior oblique muscle.

(b) At the inner end of the sphenoidal fissure, between the two heads of the external rectus muscle, and in order from above downwards, are:—

1. The upper division of the third cranial nerve.
2. The nasal nerve.
3. The lower division of the third cranial nerve.
4. The sixth cranial nerve.

The Capsule of Tenon.—This structure is described, with the eye, in the volume dealing with the special senses.

The Lachrymal Apparatus.—The lachrymal apparatus may be described as consisting of two parts,—one for the secretion of the lachrymal fluid, the other for its removal to the nose.

These various parts are as follows:—

For the secretion of the lachrymal fluid—

The lachrymal gland.

For the removal of the lachrymal fluid to the nose—

The puncta lachrymalia.

The lachrymal canals, or the canaliculi.

The lachrymal sac.

The nasal duct.

The Lachrymal Gland.—The lachrymal gland is an oval, almond-shaped gland, situated in the hollow on the inner side of the external angular process of the frontal bone.

Its *upper* surface is convex, and is in contact with the periosteum, to which it is attached.

The *lower* surface is concave, and rests upon the eyeball and the external rectus muscle.

The ducts of the lachrymal gland, from eight to twelve in number, open on the conjunctival surface in a curved line just above the outer part of the upper eyelid.

The lachrymal fluid having been secreted by this gland, passes across the eyeball to the inner side of the orbit, where it is removed by the various structures forming the remaining parts of the lachrymal apparatus.

The Puncta Lachrymalia.—The puncta lachrymalia, one in each eyelid, are the external orifices of the lachrymal canals. The puncta are situated on the free edge of each

eyelid, on the summit of the papilla lachrymalis, and about quarter of an inch from the inner canthus.

The Lachrymal Canals, or the Canaliculi.—The lachrymal canals, or the canaliculi, pass from the puncta, and convey the tears to the lachrymal sac. From each punctum the canaliculus passes first vertically, and then turns inwards until the two canals unite, to terminate in the lachrymal sac, rather above its middle, either separately or by a common orifice.

The Lachrymal Sac.—The lachrymal sac and the nasal duct are, in reality, one continuous structure, which extends from the inner side of the orbit to the inferior meatus of the nasal fossa. The lachrymal sac is the upper dilated part, and the nasal duct the lower part, of this continuous structure.

The lachrymal sac is situated in the hollow formed by the nasal processes of the superior maxillary and lachrymal bones. The lachrymal canals, or the canaliculi, open into its outer side. The internal tarsal ligament crosses the sac anteriorly, and the nasal duct opens out of it inferiorly.

The Nasal Duct.—The nasal duct is about half an inch in length, and descends almost vertically from the lachrymal sac to the anterior part of the inferior meatus of the nose. It is entirely surrounded by bone.

XI. THE MOUTH, TONGUE, PHARYNX, AND SOFT PALATE

The Mouth.—The mouth forms the entrance to the alimentary canal. Its cavity extends from the lips in front to the anterior pillars of the fauces behind.

The cavity of the mouth is divided by the alveolar arches and teeth, into two parts, as follows:—

An outer part, or the vestibulum oris.

An inner part, the mouth proper, or the cavum oris.

The Outer Part, or the Vestibulum Oris.—The vestibulum oris is that part which lies outside the teeth. It is bounded as follows:—

Externally, by the lips and cheeks.

Internally, by the teeth and gums.

In front, it opens on to the face by means of the oral fissure.

Behind, it communicates, on either side, with the mouth proper by a small aperture behind the last molar tooth.

The *roof* and *floor* are formed by the reflection of the mucous membrane from the lips and cheeks to the alveolar processes. In the middle line in front, in both the upper and lower lips, this reflection of mucous membrane is interrupted by a small vertical fold called the *frænum labii*.

The vestibulum oris receives, on each side, the secretion from the parotid gland.

The Inner Part, the Mouth Proper, or the Cavum Oris.—The mouth proper, or the cavum oris, is that part which lies internal to the teeth. It is bounded as follows:—

In front and laterally, by the gums and teeth.

Behind, the mouth communicates with the pharynx by means of the isthmus faucium.

The *floor* is formed by the tongue and by the mucous membrane which passes to the lower jaw. In the middle line of the floor of the mouth the mucous membrane is raised up, just below the tip of the tongue, to form the *frænum linguæ*. On each side of the frænum linguæ there is a slight ridge which indicates the position of the subjacent sublingual gland, and at the anterior end of this ridge there is the minute orifice of Wharton's duct, behind which are some of the orifices of the ducts of Rivinus.

The *roof* is formed by the hard and soft palates, and is vaulted. When the mouth is closed the upper or dorsal surface of the tongue is in contact with the palate, and the cavity of the mouth tends to be obliterated.

The cavity of the mouth receives, on each side, the secretion from the submaxillary and sublingual glands.

The Lips.—The lips surround the opening of the mouth. The lower lip is the larger and the more movable of the two. In each lip there are, in order from backwards, the following strata:—

1. The skin.

2. The orbicularis oris muscle.

3. The labial glands and the coronary arteries.

4. The mucous membrane.

The Cheeks.—The cheeks extend from the commissure of the lips in front to the ascending ramus of the lower jaw behind. Above and below, each cheek is attached, by means of its principal constituent—the buccinator muscle—to the alveolar margins of the upper and lower jaws respectively.

In each cheek six strata may be described, as follows:—

1. The skin.

2. A fatty layer containing the facial vessels, some of the branches of the facial nerve, and the following facial muscles:—

(a) The zygomatici muscles.

(b) The risorius muscle.

(c) The posterior fibres of the platysma myoides muscle.

3. The buccal aponeurosis.

4. The buccinator muscle.

5. The buccal glands.

6. The mucous membrane.

The duct of the parotid gland traverses the four innermost strata of the cheek and opens into the cavity of the vestibulum oris opposite the second molar tooth of the lower jaw.

The Teeth.—In the adult there are thirty-two teeth, sixteen in each jaw. These are set in the alveolar borders in the two jaws in the form of an arch with its convexity forwards, and are surrounded by the gums. When the mouth is closed the teeth of the upper jaw overhang those in the lower jaw.

The teeth of the child differ in their number from those in the adult, as in the former there are only twenty teeth as against the thirty-two of the latter. The names of the teeth from the middle line backwards, in both the child and the adult, may be tabulated thus:

<i>Adult.</i>	<i>Child.</i>
Central incisor.	Central incisor.
Lateral incisor.	Lateral incisor.
Canine.	Canine.
First bicuspid.	Nil.

<i>Adult (contd.).</i>	<i>Child (contd.).</i>
Second bicuspid.	Nil.
First molar.	First molar.
Second molar.	Second molar.
Third molar.	Nil.

The Isthmus Faucium.—The isthmus faucium is the communication between the cavity of the mouth proper and that of the pharynx.

It has the following boundaries:—

Above.—The soft palate, with the uvula depending downwards from its central part.

Below.—The dorsum of the tongue.

Laterally.—By the anterior and posterior pillars of the fauces, and in the spaces between the two, the tonsils.

The Tongue.—The tongue is an ovoid, flattened, muscular organ which occupies the floor of the mouth, and forms part of the anterior wall of the oral pharynx.

The tongue may be described as presenting for examination the following parts:—

A root or lower fixed portion.

A body.

(a) Superior or dorsal surface.

(b) Inferior or ventral surface.

A tip.

The Root of the Tongue.—The root of the tongue is its most fixed portion. It is attached to the hyoid bone, and is also connected posteriorly to the anterior surface of the epiglottis by means of three folds of mucous membrane, termed the middle and lateral *glosso-epiglottidean folds*.

The Body of the Tongue.—(a) *The Upper or Dorsal Surface.*—The upper or dorsal surface of the tongue is convex throughout its whole extent, with a slight, mesially situated, antero-posterior depression. This surface is covered by mucous membrane throughout its whole extent, and is closely related to the hard and soft palates, the uvula, and the pharynx.

(b) *The Inferior or Ventral Surface.*—The inferior or ventral surface is free, and covered by mucous membrane in its anterior third only. The posterior two-thirds is connected to the lower jaw, hyoid bone, and styloid process by the extrinsic muscles of the tongue, and it is in this part that the various vessels and nerves enter or leave the tongue.

The Tip of the Tongue.—The tip of the tongue is convex and freely movable, and is ordinarily in contact with the incisor teeth, but is capable of being protruded beyond this point.

The Mucous Membrane of the Tongue.—The mucous membrane on the *dorsal surface* of the tongue is quite naturally divided into two unequal parts—an anterior two-thirds and a posterior third.

The line of demarcation between the two parts is formed by a mesially situated recess, the *foramen cæcum*, and on either side of this by a shallow groove, the *sulcus terminalis* of His, which passes forwards and outwards from the foramen cæcum to the lateral margin of the tongue.

(a) *The Mucous Membrane over the Anterior Two-Thirds.*—In this part of the dorsal surface the mucous membrane is thin, firmly adherent to the subjacent muscles, and is provided with numerous small eminences termed *papillæ*. Three varieties of these papillæ are described:—

The circumvallate papillæ.

The fungiform papillæ.

The conical and filiform papillæ.

The Circumvallate Papillæ.—The circumvallate papillæ, some seven or twelve in number, almost coincide in position with the sulcus terminalis of His, and still further assist in dividing the mucous membrane of the dorsal surface of the tongue into its two unequal portions. They pass from the mesially situated foramen cæcum, in two lateral rows, which extend outwards and forwards to the lateral margins of the tongue in the form of a wide V-shaped figure.

Each circumvallate papilla has the form of a truncated cone, which is situated in a circular depression in the mucous

membrane. It is attached to the bottom of this depression by a constricted stem which is surrounded by a groove; the wider upper end or base projects slightly above the surface of the tongue, and is covered by small simple papillæ.

The Fungiform Papillæ.—The fungiform papillæ are more numerous than the circumvallate papillæ, but are not so large. They are found scattered over the central and anterior portions of the dorsum of the tongue, but are most numerous at the tip and along the lateral borders.

Each fungiform papilla is narrow at its attachment to the tongue, but broadens out as the free extremity is approached. In the living subject the fungiform papillæ may be distinguished by their bright red colour.

The Conical and Filiform Papillæ.—The conical and filiform papillæ are the smallest and the most numerous. They constitute the numerous small projections which are densely set over the dorsal surface of the tongue. These papillæ taper from their base towards the free extremity, where many of them are provided with smaller secondary papillæ.

(b) *The Mucous Membrane over the Posterior Third.*—The mucous membrane over the posterior third of the dorsal surface of the tongue is thicker, smoother, and less adherent than is that over the anterior two-thirds. It is not covered by papillæ, but is studded all over with numerous glands and lymphoid follicles, which last are sometimes termed the *lingual tonsils*.

On the *inferior surface* of the body of the tongue the mucous membrane is smooth and thin. It is raised up anteriorly in the middle line to form the *frænum linguæ*. On either side and in front of the *frænum linguæ* the ranine vein and occasionally the artery can be seen shining through the mucous membrane on the inferior surface of the tongue, whilst external to these vessels, and extending from the tip of the tongue backwards and outwards, there is on each side a second slight fold of mucous membrane termed the *plica fimbriata*.

The Foramen Cæcum and Thyro-Glossal Duct.—The

foramen cæcum is a small, blind recess situated in the middle line of the dorsal surface of the tongue, at the junction of its anterior two-thirds with the posterior third, that is, immediately behind the apex of the V-shaped figure which is formed by the circumvallate papillæ.

The foramen cæcum is stated by His to indicate the position of the epithelial outgrowth from which the median portion of the thyroid gland has been formed, this gland being connected to the foramen cæcum by the *thyro-glossal* duct; this duct eventually disappears, with the possible exception of its upper end, which may persist in the adult as a canal—the *ductus lingualis*—which extends from the foramen cæcum to the hyoid bone. The remaining portions of the thyro-glossal duct are probably represented, in the adult, by the middle lobe of the thyroid body and the levator glandulæ thyroideæ muscle.

His's views on the early intrinsic connection of the tongue with the thyroid body are denied by Kanthack.

The Muscles of the Tongue.—The tongue is composed chiefly of muscular fibres running in various directions. The various muscles which compose the tongue substance are divisible into two great groups—extrinsic and intrinsic.

The *extrinsic* muscles of the tongue are the muscles which attach the tongue to other parts; they are chiefly found at the base and inferior surface of the tongue, and are four in number, as follows:—

The hyo-glossus.

The chondro-glossus.

The genio-hyo-glossus.

The stylo-glossus.

The *intrinsic* muscles of the tongue are placed entirely within its substance. Four such muscles may be described:—

The lingualis superior.

The lingualis inferior.

The transversalis muscle.

The perpendicular muscular fibres.

These muscles are too unimportant to require description, and the extrinsic muscles are described elsewhere.

The Nerves of the Tongue.—The various nerves of the tongue are best classified according to their function :—

	Anterior Two-thirds.	Posterior Third.
Nerves of ordinary sensation.	The lingual.	Glosso-pharyngeal.
Nerves of special sensation (taste).	The chorda tympani.	{ Glosso-pharyngeal. Superior laryngeal.
Motor nerve.	The hypoglossal nerve.	

The Vessels of the Tongue.—The *arterial* supply of the tongue is derived almost entirely from the lingual artery and its dorsalis linguæ branch. A few small arteries are also given off to the tongue by the facial and ascending pharyngeal arteries.

The *venous return* is by means of the various veins described on page 131, into the internal jugular vein.

The Lymphatics of the Tongue.—The greater number of the lymphatic vessels from the tongue accompany the ranine vessels, through some small glands on the external surface of the hyo-glossus muscle, into the superior deep cervical glands.

A smaller proportion of the lymphatic vessels from the tongue pass through the mylo-hyoid muscle to the sub-maxillary lymphatic glands below the body of the lower jaw, and thence into both the superficial cervical glands along the external jugular vein, and into the superior deep cervical glands.

A study of the lymphatic return from the tongue is of importance in connection with malignant disease of that organ.

The Pharynx.—The pharynx is that portion of the alimentary canal which gives passage to both food and air. It is situated behind the nose, mouth, and larynx.

The pharynx extends from the base of the skull to the lower border of the sixth cervical vertebra, where it terminates by becoming directly continuous with the œsophagus.

The pharynx lies *in front* of the basilar process of the

occipital bone and the upper six cervical vertebræ; and as it lies *behind* the nose, mouth, and larynx, it is divided into three parts—nasal, oral, and laryngeal.

Relations of the Pharynx.—The relations of the pharynx as a whole are of some considerable practical importance.

In Front.—The anterior wall of the pharynx lies behind the nose, mouth, and larynx, and as the pharynx communicates freely with these cavities it follows that this wall of the pharynx is deficient in places, the various deficiencies constituting the apertures of communication with the previously mentioned cavities.

Behind.—The posterior wall of the pharynx is completely closed by the insertions of the three constrictor muscles of the pharynx. It is only separated from the prevertebral fascia, muscles, and cervical vertebræ by some loose areolar tissue, which permits of the free movement of the pharynx.

Laterally.—The principal lateral relations of the pharynx are the internal carotid artery, internal jugular vein, the large nerves found in the deep dissection of the neck, and the styloid process and its attached muscles.

Structure of the Pharyngeal Walls.—The pharyngeal walls are composed, from without inwards, of the following structures:—

A layer of fascia, the bucco-pharyngeal fascia.

A muscular coat, comprising—

The superior constrictor muscle of the pharynx.

The middle constrictor muscle of the pharynx.

The inferior constrictor muscle of the pharynx.

The stylo-pharyngeus muscle.

A layer of fibrous tissue, the pharyngeal aponeurosis.

Mucous membrane.

The Bucco-Pharyngeal Fascia.—This is a strong layer of fascia investing the constrictor muscles, and loosely attached *posteriorly* to the prevertebral fascia by some loose areolar tissue. The space which this tissue occupies lies between the bucco-pharyngeal fascia in front, and the prevertebral fascia behind, and is termed the *retro-pharyngeal space*.

Anteriorly, the bucco-pharyngeal fascia is attached to the

pterygo-maxillary ligament, by means of which it becomes continuous with the buccal aponeurosis over the buccinator muscle, the whole sheet being called the bucco-pharyngeal fascia.

The Pharyngeal Venous Plexus.—The various veins from the pharynx, soft palate, and prevertebral region form a well-marked venous plexus which lies upon the posterior and lateral walls of the pharynx.

This plexus communicates with the pterygoid venous plexus, and terminates in two or three venous channels which open into the internal jugular vein about the level of the hyoid bone.

The Muscles of the Pharynx.—These are four in number, as follows:—

The superior constrictor.	} The pharyngeal plexus.
The middle constrictor.	
The inferior constrictor.	
The stylo-pharyngeus. The glosso-pharyngeal nerve.	

The constrictor muscles correspond to the circular muscular coat of the alimentary canal, and the stylo-pharyngeus to the longitudinal muscular coat.

The pharyngeal plexus, which supplies the three constrictors, is formed by the pharyngeal branches of the glosso-pharyngeal, vagus, and sympathetic nerves. It lies on the lateral wall of the pharynx.

The Superior Constrictor Muscle of the Pharynx.—This muscle surrounds the naso-pharynx.

Origin.—The superior constrictor arises in front, and from above downwards, from the following structures:—

The lower third of the posterior border of the internal pterygoid plate, and the hamular process.

The pterygo-maxillary ligament.

The posterior extremity of the mylo-hyoid ridge of the lower jaw.

The mucous membrane of the mouth and the side of the tongue.

Insertion.—The muscular fibres sweep backwards round the upper part of the pharynx, to be inserted into the median raphè at the back of the pharynx, some of the fibres extending as high as the pharyngeal tubercle.

Nerve Supply.—The pharyngeal plexus, formed by the pharyngeal branches of the glosso-pharyngeal, vagus, and sympathetic nerves.

Action.—The superior constrictor, lying as it does above the oral pharynx, cannot act upon the food. It draws the lateral walls of the naso-pharynx together, thus approximating the posterior pillars of the fauces.

Relations.—The *upper margin* of the muscle is concave and free, and surrounds the levator palati muscle and the Eustachian tube. The interval between this border and the base of the skull is sometimes termed the *sinus of Morgagni*.

The *lower margin* is concealed from view by the middle constrictor muscle.

The *external surface* is concealed in great part by the middle constrictor muscle. It is also in contact with the internal carotid artery, the vagus, and sympathetic nerves.

The *internal surface* is lined by mucous membrane, and conceals from view the palato-pharyngeus muscle and the tonsil.

The stylo-pharyngeus muscle descends in the interval between the superior and middle constrictors, whilst anteriorly the superior constrictor is united to the buccinator muscle by the pterygo-maxillary ligament.

The Middle Constrictor Muscle of the Pharynx.—This muscle lies opposite to and surrounds the oral pharynx.

Origin.—From the greater and lesser cornua of the hyoid bone, and from the stylo-hyoid ligament.

Insertion.—The muscular fibres sweep backwards round the oral pharynx, to be inserted into the median raphe, the highest fibres extending almost as high as the basilar portion of the occiput.

Nerve Supply.—The pharyngeal plexus.

Action.—Contracts the pharynx from before backwards.

Relations.—The upper border of this muscle is separated from the superior constrictor by the stylo-pharyngeus muscle. In the interval between the origin of the middle and inferior constrictors the superior laryngeal vessels and the internal laryngeal nerve pierce the thyro-hyoid membrane.

The Inferior Constrictor Muscle of the Pharynx.—This muscle lies opposite to and surrounds the laryngeal pharynx.

Origin.—This muscle arises from the upper tubercle, oblique line, and inferior cornu of the thyroid cartilage, and from the cricoid cartilage.

Insertion.—The muscular fibres sweep backwards, to be inserted into the median raphè.

Nerve Supply.—The pharyngeal plexus.

Action.—Contracts the pharynx from before backwards.

Relations.—The *external surface* of the inferior constrictor is in contact posteriorly with the cervical vertebræ and the prevertebral muscles; laterally, with the thyroid body, the internal and external carotid arteries, and with the sternothyroid muscle.

The *internal or deep surface* conceals from view part of the middle constrictor muscle, the stylo-pharyngeus and palato-pharyngeus muscles, and the mucous membrane of the pharynx.

At the *upper border* of the inferior constrictor muscle are the superior laryngeal vessels and the internal laryngeal nerve.

At the *lower border* the inferior laryngeal vessels and nerve pass upwards to the larynx.

The Stylo-Pharyngeus Muscle.—This muscle has been described on page 132.

The Pharyngeal Aponeurosis.—This fascial layer lies internal to the constrictor muscles, between them and the mucous membrane. It is found chiefly at the upper part of the pharynx.

Above, it is attached to the basi-occiput and the petrous temporal, and this constitutes the principal means of attachment of the pharynx to the base of the skull; below, it becomes lost on the internal surface of the pharyngeal muscles.

The Mucous Membrane.—The mucous membrane of the pharynx contains a large quantity of lymphoid tissue, especially at the upper and back parts of the naso-pharynx. This is very apt to become hypertrophied in children, forming the so-called adenoid growths.

The Interior of the Pharynx.—In connection with

the interior of the pharynx there are seven openings, as follows:—

The naso-pharynx—

The two posterior nares, or the choanæ.

The two Eustachian tubes.

The oral pharynx—

The oral aperture.

The laryngeal pharynx—

The laryngeal orifice.

The œsophageal orifice.

Projecting into the anterior wall of the pharynx is the soft palate. During the process of deglutition the soft palate is drawn upwards and backwards against the posterior wall of the pharynx, and so shuts off the naso-pharynx from the oral pharynx.

The Naso-Pharynx.—The naso-pharynx, or the uppermost part of the pharynx, is somewhat irregularly quadrilateral in shape, with four walls, anterior and posterior, and two lateral. None of these walls are movable. When the soft palate is elevated a floor may be said to exist, and this then constitutes the only movable portion of the naso-pharynx.

The Anterior Wall.—The anterior wall of the naso-pharynx is entirely occupied by the openings of the two posterior nares, or choanæ, which connect the naso-pharynx with the nasal fossæ.

The posterior nares, or the choanæ, are two oval apertures, about one inch in length by half an inch in breadth, which are separated from each other in the middle line by the posterior free edge of the vomer.

In the dried condition of the parts the posterior nares are bounded as follows:—

Above, by the sphenoid, palate, and vomer; *below*, by the horizontal process of the palate; *externally*, by the internal pterygoid plate; and *internally*, by the posterior free edge of the vomer.

The Posterior Wall.—This wall is formed principally by the various constrictor muscles of the pharynx. The mucous membrane is thickened, and embedded in this wall there is a

quantity of lymphoid tissue, termed the *pharyngeal tonsil*, or the tonsil of Luschka. Immediately below this there is in young subjects a recess, known as the *middle pharyngeal recess*. It projects upwards in the middle line as far as the pharyngeal tubercle.

The Lateral Walls.—The most prominent objects seen in the lateral walls of the naso-pharynx are the trumpet-shaped extremities of the Eustachian tubes. Each tube opens into the side wall of the naso-pharynx on a level with the posterior extremity of the inferior turbinate bone of the nasal fossæ.

The pharyngeal orifice of the tube is oval in form, and its posterior edge is so prominent as to give it its peculiar trumpet-shaped appearance. Immediately behind this prominent posterior edge of the Eustachian tube there is, in the lateral wall of the naso-pharynx, a deep recess passing backwards and outwards. It is termed the *lateral pharyngeal recess*, or the fossa of Rosenmüller, and is the remains of the upper end of the second visceral cleft of the embryo.

The Oral Pharynx.—The oral pharynx is situated behind the mouth, below the soft palate, and above the level of the larynx. Its form and size vary, on account of the mobility of its walls. In front it communicates with the mouth by means of the oral aperture of the pharynx, and below that, it is bounded anteriorly by the dorsal surface of the tongue.

The oral aperture of the pharynx, or the isthmus faucium, is bounded—*above*, by the soft palate, with the uvula depending downwards from its central part; *below*, by the dorsum of the tongue; and *laterally*, by the anterior and posterior pillars of the fauces, and, in the spaces between the two, the tonsils.

The posterior pillars of the fauces contain the palatopharyngeus muscles, and gradually disappear on the side wall of the pharynx.

The *tonsils* are two masses of lymphoid tissue lying between the anterior and posterior pillars of the fauces. They extend from the soft palate above to the epiglottis below, and externally they are in contact with the superior constrictors of the pharynx.

The tonsils are exceedingly vascular, and derive their *arterial* supply from the tonsillar and palatine branches of the

facial artery, from the descending palatine branch of the third part of the internal maxillary artery, and from the ascending pharyngeal and dorsalis linguæ arteries.

The *veins* form a plexus, the *tonsillar plexus*, and the nerves are derived from the glosso-pharyngeal and the fifth cranial nerves.

The Laryngeal Pharynx.—The laryngeal pharynx is situated opposite the total length of the larynx, and is as long as the nasal and oral portions of the pharynx combined. The anterior wall of this part of the pharynx contains, in its upper part, the laryngeal aperture, a vertically situated orifice.

The *laryngeal aperture* is bounded *above* by the epiglottis; *below* by the arytenoid cartilages and the arytenoidei muscles; and *laterally*, by the aryteno-epiglottidean folds.

Below the level of the laryngeal aperture the anterior and posterior walls of the pharynx are in contact.

At its lowest limit the laryngeal pharynx becomes continuous with the œsophagus by means of the *œsophageal aperture*. This aperture is the narrowest part of the pharynx, and is situated opposite the cricoid cartilage or the sixth cervical vertebra.

The Eustachian Tube.—The Eustachian tube is an osseous, cartilaginous, and fibrous canal which connects the naso-pharynx to the tympanum. It passes backwards, outwards, and slightly upwards, in such a way that it forms an angle of about 45° with the sagittal plane. The tube may be divided into two parts—an *anterior cartilaginous portion* and a *posterior osseous portion*.

(a) The *anterior cartilaginous* portion is about one inch in length, and is compressed laterally. It is fixed to the internal pterygoid plate of the sphenoid bone, and opens into the lateral wall of the naso-pharynx on a level with the posterior extremity of the inferior turbinate bone, and above the level of the hard palate.

In its backward and outward passage from the lateral wall of the naso-pharynx this part of the Eustachian tube lies between the origin of the levator palati, which is on the inner side of the tube, and the origin of the tensor palati, which is on its outer side.

(b) The posterior *osseous* portion is about half an inch long, and lies in the anterior border of the petrous portion of the temporal bone, that is, in the angle between the petrous and squamous temporals. The horizontal portion of the second or intra-petrous part of the internal carotid artery lies immediately to the inner side of this part of the Eustachian tube.

The Soft Palate.—The soft palate is a movable partition between the mouth and the pharynx. When depressed it shuts off the cavity of the mouth from the pharynx, and when elevated it separates the naso-pharynx from the mouth and oral pharynx. The soft palate is most usually in a state of relaxation, that is, depression, and to that condition the following description applies.

The soft palate, when depressed, presents for examination an upper and a lower border, and an anterior and a posterior surface.

The *upper border* is attached to the posterior free edge of the hard palate, that is, to the posterior borders of the horizontal or palatal processes of the two palate bones.

The *inferior border* is free and pendulous, and is prolonged downwards in the middle line in the form of a conical projection, the *uvula*. Along the middle of the uvula there is a median ridge, the indication of the original separation of the soft palate into two lateral halves.

The *posterior surface* of the soft palate is convex, and is continuous with the floor of the nasal fossæ. It looks backwards towards the posterior wall of the pharynx.

The *anterior surface* of the soft palate is concave, and looks towards the mouth.

Laterally, and descending from the soft palate to the lateral walls of the pharynx, are the anterior and posterior pillars of the fauces, containing between them a triangular interval, which lodges the tonsil.

The *anterior pillars of the fauces* spring from the anterior surface of the soft palate near the base of the uvula, and descend to the side of the tongue, rather behind its middle. They contain the palato-glossus muscles.

The *posterior pillars of the fauces* pass from the inferior

border of the soft palate to the lateral walls of the oral pharynx. They contain the palato-pharyngeus muscles.

Structure of the Soft Palate.—The various structures which are found in the soft palate are, from before backwards, as follows:—

1. The mucous membrane on the anterior surface of the uvula.
2. The submucous membrane, vessels, and glands.
3. The palato-glossus muscle.
4. The aponeurosis of the tensor palati muscles.
5. The anterior layers of the palato-pharyngeus muscles.
6. The levator palati muscles.
7. The azygos uvulæ muscles.
8. The posterior layers of the palato-pharyngeus muscles.
9. The submucous membrane, vessels, and glands.
10. The mucous membrane on the posterior surface of the uvula.

The Muscles of the Soft Palate.—The muscles of the soft palate are five in number on each side, as follows:—

Two superior muscles—

The levator palati muscles.

The tensor palati muscles.

One intermediate muscular stratum—

The azygos uvulæ muscles.

Two inferior muscles—

The palato-glossus muscles.

The palato-pharyngeus muscles.

The Levator Palati Muscles.—*Origin.*—Each levator palati muscle arises from the antero-inferior surface of the petrous temporal just in front of the carotid canal, and also from the cartilaginous portion of the Eustachian tube.

Insertion.—The muscle passes downwards and forwards across the upper border of the superior constrictor muscle of the pharynx, and after piercing the pharyngeal aponeurosis enters the soft palate, to be inserted into the aponeurosis of the palate, meeting its fellow of the opposite side just in front of the azygos uvulæ muscles.

Nerve Supply.—The pharyngeal plexus.

Action.—Elevates the soft palate.

The Tensor Palati Muscles.—*Origin.*—Each tensor palati arises from the scaphoid fossa at the base of the internal pterygoid plate, from the spine of the sphenoid, and from the cartilaginous part of the Eustachian tube.

Insertion.—The muscle descends on the inner side of the internal pterygoid muscle, to the hamular process. Turning horizontally inwards round this process, the muscle is inserted into the aponeurosis of the soft palate, and into a transverse ridge on the under surface of the palate bone.

Nerve Supply.—A branch from the otic ganglion of the inferior maxillary division of the fifth cranial nerve.

Action.—Fixes and renders tense the soft palate.

The Azygos Uvulae Muscles.—The azygos uvulae consists in reality of two separate muscles. It is not, as its name would imply, a single muscle.

Origin.—Each azygos muscle arises from the aponeurosis of the soft palate and from the posterior nasal spine, on the posterior free edge of the hard palate. Each muscle descends into the uvula.

Nerve Supply.—The pharyngeal plexus.

Action.—Elevates the uvula.

The Palato-Glossus Muscles.—These muscles occupy the anterior pillars of the fauces.

Origin.—From the aponeurosis of the soft palate.

Insertion.—Into the side of the tongue.

Nerve Supply.—The pharyngeal plexus.

Action.—Closes the isthmus of the fauces, thus assisting to shut off the cavity of the mouth from that of the pharynx.

The Palato-Pharyngeus Muscles.—These muscles occupy the posterior pillars of the fauces.

Origin.—Each muscle arises by two layers, which embrace between them the levator palati and azygos uvulae muscles.

The *anterior* layer arises from the posterior border of the horizontal or palatal process of the palate bone and from the palatal aponeurosis, some of its fibres mingling with those from the opposite side.

The *posterior* layer consists of a few scattered fibres which become continuous with the corresponding portion of the

muscle of the opposite side. This part of the palato-pharyngeus is the most posterior muscle in the soft palate.

Beyond the limits of the soft palate the two muscular layers of the palato-pharyngeus come together, and are joined by a few muscular slips from the lower and anterior portion of the cartilage of the Eustachian tube. These last constitute the *salpingo-pharyngeus muscle*.

Insertion.—From the foregoing origin each palato-pharyngeus muscle passes downwards and backwards in the posterior pillar of the fauces, to be inserted into the upper and posterior borders of the thyroid cartilage.

Nerve Supply.—The pharyngeal plexus.

Action.—Approximates the posterior pillars of the fauces, and depresses the soft palate.

The Sensory Nerves of the Soft Palate.—The sensory nerves of the soft palate are the external and posterior palatine nerves from Meckel's ganglion. They supply the mucous membrane.

The Motor Nerves of the Soft Palate.—The levator palati, azygos uvulæ, palato-glossus and palato-pharyngeus muscles are supplied by the pharyngeal plexus, but more especially by the vagal pharyngeal branch of that plexus, which conveys motor fibres to these muscles from the spinal accessory nerve.

The tensor palati muscle is supplied by the otic ganglion which conveys motor fibres to the muscle from the motor root of the fifth cranial nerve.

The Arteries of the Soft Palate.—The inferior or ascending palatine branch of the facial is the chief arterial vessel for the soft palate, but it also derives branches from the ascending pharyngeal branch of the external carotid artery, and from the descending palatine branch of the internal maxillary artery.

XII. THE SPHENO-MAXILLARY FOSSA AND THE ADJACENT STRUCTURES

Definition.—This region includes a number of structures which require a special dissection, and are difficult to classify with other regions.

The Superior Maxillary Division of the Fifth Cranial Nerve.—The superior maxillary division of the fifth cranial nerve commences within the cranial cavity at the middle of the Gasserian ganglion, and, passing horizontally forwards, leaves the skull and enters the sphenomaxillary fossa through the foramen rotundum. Crossing the upper part of that fossa, the nerve enters the infra-orbital canal in the floor of the orbit, and, becoming the *infra-orbital nerve*, emerges at the infra-orbital foramen on the face as the infra-orbital nerve.

Branches.—The branches of the superior maxillary division of the fifth and of its direct continuation, the infra-orbital nerve, may be classified as follows:—

Within the cranium—

A recurrent branch.

Within the sphenomaxillary fossa—

The orbital nerve.

The sphenopalatine branches to Meckel's ganglion.

The posterior superior dental nerve.

Within the substance of the superior maxilla—

The middle superior dental nerve.

The anterior superior dental nerve.

On the face—

Terminal branches.

The Recurrent Branch.—Within the cranial cavity the superior maxillary division of the fifth cranial nerve gives off, near its origin, a minute recurrent branch for the supply of the dura mater.

The Orbital Nerve.—This nerve arises within the sphenomaxillary fossa. Its further course has been described upon page 166.

The Sphenopalatine Branches.—These two branches descend for a very short distance to Meckel's ganglion, of which they constitute the sensory roots.

The Posterior Superior Dental Nerve.—This nerve arises from the trunk of the superior maxillary division of the fifth cranial nerve just before it enters the infra-orbital canal. The nerve then descends, in company with the posterior superior dental artery from the third part of the internal maxillary

artery, along the zygomatic surface of the superior maxilla, and, entering that bone, supplies the molar teeth of the upper jaw and the mucous membrane of the antrum of Highmore.

The Middle Superior Dental Nerve.—This nerve arises from the infra-orbital nerve within the substance of the superior maxilla, and a short distance in front of the sphenomaxillary fossa. It passes downwards and forwards in the outer wall of the antrum of Highmore, to supply the bicuspid teeth of the upper jaw.

The Anterior Superior Dental Nerve.—This nerve, the largest of the three dental nerves, descends in front of the antrum of Highmore, to supply the incisor and canine teeth of the upper jaw, and also gives off a nasal branch to the outer wall of the nasal fossa.

The Terminal Branches.—The terminal branches of the infra-orbital nerve supply the skin of the face. (*See page 100.*)

Meckel's Ganglion, or the Spheno-Palatine Ganglion.—This ganglion is connected with the superior maxillary division of the fifth cranial nerve, in just the same way as the ciliary ganglion is connected with the ophthalmic division, and the otic and submaxillary ganglia with the inferior maxillary division of the fifth nerve.

Meckel's ganglion is very deeply situated in the sphenomaxillary fossa, immediately to the outer side of the sphenopalatine foramen, and below the trunk of the superior maxillary division of the fifth cranial nerve, from which it appears suspended by the sphenopalatine branches which are given off to it from that nerve. It is of a reddish-grey colour, and somewhat triangular in outline.

The Roots of Meckel's Ganglion.—The roots of Meckel's ganglion are as follows:—

Motor fibres are conveyed to the ganglion, from the facial nerve, through the medium of the great superficial petrosal and Vidian nerves.

Sensory fibres through the sphenopalatine branches, from the superior maxillary division of the fifth.

Sympathetic fibres are conveyed to the ganglion from the sympathetic by way of the carotid plexus, great deep petrosal nerve, and the Vidian nerve.

Branches.—The branches of Meckel's ganglion are numerous; they may be classified according to the direction which they take, as follows:—

Passing upwards—

Orbital branches.

Passing downwards—

The large or anterior palatine nerve.

The small or posterior palatine nerve.

The external palatine nerve.

Passing inwards—

The superior nasal branches.

The naso-palatine nerve.

Passing backwards—

The Vidian nerve.

The pharyngeal nerve.

The Orbital Branches.—The orbital branches pass upwards into the orbit through the speno-maxillary fissure to supply the periosteum.

The Large or Anterior Palatine Nerve.—This nerve descends in the posterior palatine or palato-maxillary canal to the hard palate, along which it extends forwards nearly to the incisor teeth.

It supplies the palate and gums, and is joined in front near the anterior palatine foramen by the naso-palatine nerve. During its passage through the posterior palatine canal the nerve also gives off two *inferior nasal branches*, which enter the nasal fossa at its posterior part through a small aperture in the vertical plate of the palate, to supply the mucous membrane over the posterior part of the outer wall of the nasal fossa with ordinary sensation.

The Small or Posterior Palatine Nerve.—The small or posterior palatine nerve descends in the lesser palatine canal to the soft palate, uvula, and tonsil.

The External Palatine Nerve.—This nerve passes downwards through the external palatine canal between the superior maxilla and the tuberosity of the palate bone, to supply the tonsil and the soft palate.

The Superior Nasal Branches.—The superior nasal branches enter the nasal fossa through the speno-palatine

foramen. They supply the mucous membrane over the upper and middle turbinated bones, and a small part of the nasal septum.

The Naso-Palatine Nerve.—This nerve enters the nasal fossa through the sphenopalatine foramen, and, crossing the roof of the nose, gains the inner or septal wall of the nasal fossa, where it turns downwards and forwards in a slight groove on the vomer as far as the anterior palatine canal.

Both the naso-palatine nerves descend to the palate through this canal, the left naso-palatine passing through the more anterior of the two foramina of Scarpa, which are found within the anterior palatine canal.

The naso-palatine nerves, having reached the hard palate, communicate with the large or anterior palatine nerve. They supply the septum nasi and the hard palate.

The Vidian Nerve.—This nerve passes backwards through the Vidian canal to its posterior end, where it is seen to be formed by the junction of the great superficial petrosal nerve from the facial, and the great deep petrosal nerve from the carotid plexus. The Vidian nerve is the path by means of which both the motor and sympathetic roots of Meckel's ganglion are conveyed to their ultimate destination. It is therefore somewhat misleading to regard the Vidian nerve as one of the branches of the ganglion.

The Pharyngeal Nerve.—The small pharyngeal nerve passes backwards through the pterygo-palatine canal just internal to the Vidian nerve. It supplies the mucous membrane of the pharynx behind the Eustachian tube.

The Branches from the Third Part of the Internal Maxillary Artery.—The third part of the internal maxillary artery gives off, in the neighbourhood of the sphenomaxillary fossa, numerous small branches, as follows:—

The posterior superior dental artery.

The descending or superior palatine artery.

The Vidian artery.

The pterygo-palatine artery.

The nasal or sphenopalatine artery.

The infra-orbital artery.

The Posterior Superior Dental Artery.—The posterior superior dental artery has already been described. (See page 115.)

The Descending or Superior Palatine Artery.—This artery descends through the posterior palatine canal, accompanied by the large or anterior palatine nerve, to the hard palate which it supplies. It anastomoses in front with the naso-palatine artery, and in its descent through the posterior palatine canal gives off a few minute branches to the nasal fossa.

The Vidian Artery.—The Vidian artery passes backwards through the Vidian canal, to supply the Eustachian tube, the levator palati muscle, and the pharynx.

The Pterygo-Palatine Artery.—This small vessel passes backwards through the canal of the same name to the pharynx; it lies to the inner side of the Vidian artery.

The Nasal or Spheno-Palatine Artery.—The nasal or spheno-palatine artery passes inwards into the nasal fossa, through the spheno-palatine foramen, in company with the superior nasal and naso-palatine nerves, to supply the nasal mucous membrane.

Within the nasal fossa it gives off the *naso-palatine artery*, which passes downwards and forwards on the septum of the nose to anastomose in the hard palate with the descending or superior palatine artery.

The Infra-Orbital Artery.—This vessel represents the termination of the internal maxillary artery on the face. It leaves the spheno-maxillary fossa and enters the infra-orbital canal in the superior maxilla, and, running along that canal with the infra-orbital nerve, emerges on the face at the infra-orbital foramen.

Whilst within the substance of the superior maxilla, the artery gives off the *anterior superior dental artery* for the supply of the incisor and canine teeth and the mucous membrane of the antrum of Highmore.

The Intra-Petrous Portion of the Facial Nerve.—The facial nerve, from the point at which it disappears in the internal auditory meatus to the point at which it reappears at the stylo-mastoid foramen at the base of the skull, pursues

a tortuous course through the petrous portion of the temporal bone.

The facial nerve leaves the interior of the skull at the internal auditory meatus, at the bottom of which it enters the aqueduct of Fallopius.

The nerve then passes horizontally outwards, in the substance of the petrous temporal, between the cochlea and the vestibule, until it reaches the inner wall of the tympanum.

At this situation the nerve suddenly bends backwards above the fenestra ovalis, forming, by means of this bend, the *geniculate ganglion* of the facial nerve.

Lastly, the nerve arches downwards behind the pyramid and the cavity of the tympanum, to emerge from the substance of the bone at the stylo-mastoid foramen.

Branches.—The branches which the intra-petrous portion of the facial nerve give off may be classified as follows:—

Communicating branches—

To the auditory nerve.

To the small superficial petrosal nerve.

To the auricular branch of the vagus nerve.

Branches of distribution—

The great superficial petrosal nerve.

The external superficial petrosal nerve.

The nerve to the stapedius muscle.

The chorda tympani.

The Great Superficial Petrosal Nerve.—This nerve passes from the geniculate ganglion forwards, to emerge from the substance of the bone at the hiatus Fallopii. The nerve then passes forwards and inwards below the Gasserian ganglion and along the outer side of the second part of the internal carotid artery, to unite with the great deep petrosal nerve from the carotid plexus to form the Vidian nerve, which passes to Meckel's ganglion.

The External Superficial Petrosal Nerve.—The external superficial petrosal nerve passes from the geniculate ganglion to the sympathetic filaments upon the large middle meningeal artery. This nerve is not always present.

The Nerve to the Stapedius Muscle.—This small nerve

arises from the facial nerve as it is passing behind the pyramid. It enters the base of the pyramid in order to reach its muscle.

The Chorda Tympani.—The chorda tympani arises from the facial nerve at the lower end of the aqueduct of Fallopius, and runs upwards and forwards to the posterior wall of the tympanum, which it enters below the base of the pyramid and close to the membrana tympani. The chorda tympani then arches forwards across the internal surface of that membrane, lying to the inner side of the handle of the malleus and above the insertion of the tensor tympani, and finally leaves the tympanic cavity at the inner end of the Glaserian fissure, to enter the pterygo-maxillary region where it joins the lingual nerve.

XIII. THE NASAL FOSSÆ

The Cavity of the Nose.—The cavity of the nose is the chamber which contains the special organ of the sense of smell. It occupies a central position amongst the bones of the face, lying between the two orbits, below the cranium and above the mouth.

The cavity of the nose is divided by means of a mesially situated vertical partition—the *septum nasi*—into two bilateral chambers, the *nasal fossæ*.

The Septum Nasi.—The septum nasi divides the cavity of the nose into right and left nasal fossæ, and therefore constitutes the inner wall of each fossa. It is an osseous and cartilaginous structure, which is composed of the following parts :—

Bones—

The central vertical plate of the ethmoid.

The vomer.

The nasal process of the frontal.

The rostrum of the sphenoid.

The crests of the nasal, superior maxillary, and palate bones.

Cartilage—

The septal cartilage.

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The Septal Cartilage.—The septal cartilage occupies the wide, angular interval which exists on the macerated skull between the central vertical plate of the ethmoid and the vomer.

The septal cartilage is an irregularly quadrilateral sheet which completes the septum nasi at its anterior and lower part. It is thicker at its margins than in the centre, and often shows a well-marked bulging or deviation to one or other side.

The *anterior* border of the septal cartilage is attached from above downwards to—

The nasal bones near their junction.

The lateral nasal cartilages.

The cartilages of the nasal aperture.

The *posterior* border is attached to the anterior border of the central vertical plate of the ethmoid.

The *inferior* border is attached from before backwards to—

The incisor crests of the superior maxillæ.

The groove of the vomer.

The *remaining* border is very short and free, and extends from the cartilages of the nasal aperture backwards to the anterior nasal spine.

The Nasal Fossæ.—The nasal fossæ are the two bilateral chambers situated on each side of the septum nasi.

The nasal fossæ are two narrow, elongated antero-posterior chambers, which communicate in front with the external air by means of the anterior nares, and behind with the nasopharynx by the posterior nares or choanæ. They also establish communications with the air sinuses of the surrounding bones, as will be seen later.

The dimensions of the nasal fossæ vary in their different parts. The antero-posterior length is greater below than above, and measures near the floor about three inches.

The vertical height of each nasal fossa is greatest in the centre, where it is about one inch and three-quarters, but is rather less than this in front and behind.

The breadth of the fossa is very narrow throughout, but is greater below than above. The upper part of the fossa is

very narrow—not more than one-eighth of an inch—and is usually named the *olfactory cleft*. It extends downwards as far as the lower border of the middle turbinate bone. The lower part of the fossa is somewhat wider, its width near the floor being about three-fifths of an inch. This portion of the fossa is termed the *respiratory passage*.

Each nasal fossa presents for examination the following parts :—

A floor.

A roof.

An internal wall (the septum nasi).

An external wall.

An anterior extremity.

A posterior aperture. (*See page 187.*)

The Floor of the Nasal Fossa.—The floor of each nasal fossa constitutes its widest part. It is almost horizontal from before backwards, and slightly concave from side to side—points to be specially remembered in connection with the passing of a Eustachian catheter.

The floor of the nasal fossa is formed from before backwards by :—

The palatal process of the superior maxilla.

The palatal process of the palate.

At its anterior part there is, in the dried skull, the incisor foramen leading into the anterior palatine canal.

The Roof of the Nasal Fossa.—The roof of the nasal fossa is horizontal in its middle portion, but slopes downwards in front and behind.

The *anterior* sloping portion of the roof is formed by :—

The lateral nasal cartilages.

The nasal bone.

The nasal process of the frontal bone.

The *intermediate* horizontal portion is formed by :—

The cribriform plate of the ethmoid.

The *posterior* sloping portion is formed by :—

The anterior surface of the body of the sphenoid.

The ala of the vomer.

The sphenoidal process of the palate.

In the dried skull there are many apertures in the roof of each nasal fossa. Most of these are situated in the cribriform plate of the ethmoid for the transmission of the olfactory nerves, together with one small aperture for the nasal nerve; in the anterior surface of the body of the sphenoid there is the opening of the sphenoidal air sinus.

The Internal Wall of the Nasal Fossa, or the Septum Nasi.—The septum nasi constitutes the internal wall for each nasal fossa. It has already been considered.

The External Wall of the Nasal Fossa.—This is the largest and the most uneven of the various nasal boundaries, its unevenness being due to the fact that projecting into the cavity of each nasal fossa from this wall are the three turbinate bones.

In each external wall there are the following structures :—

In Front—

The lateral nasal cartilage.

The cartilage of the nasal aperture.

The nasal bone.

The nasal process of the superior maxilla.

In the Middle—

The lachrymal.

The lateral mass of the ethmoid.

The inferior turbinate bone.

The nasal surface of the superior maxilla.

Behind—

The vertical plate of the palate.

The internal pterygoid plate of the sphenoid.

Of the various bones which bound the external wall of the nasal fossa, three—the nasal, lachrymal, and ethmoid—are found in the upper half of the wall only; the inferior turbinate is confined to the lower half, and the remainder extend throughout the whole vertical depth.

The Meatuses of the Nose.—Projecting inwards from the external wall of the nasal fossa are the three turbinate bones, which give rise to and produce the three meatuses of the nose.

The turbinate bones are three in number; the superior and middle turbinate bones are merely processes of the ethmoid bone, but the inferior turbinate is a separate bone. They are confined to that part of the external wall of the nasal fossa which lies above the hard palate. Between each turbinate bone and the external nasal wall are the various nasal meatuses.

The Superior Meatus.—The superior meatus, or the ethmoidal fissure, is the smallest and straightest of the three. It is strictly limited to the posterior half of the space above the hard palate.

In its *anterior* part are the one or two apertures of the posterior ethmoidal cells, and in its *posterior* part is the spheno-palatine foramen.

The Middle Meatus.—The middle meatus is larger than the superior. It extends from the posterior nares nearly as far forwards as the anterior extremity of the hard palate, and on account of its curvature the middle meatus is open in front as well as below.

In order to expose the various structures and apertures in the middle meatus it is necessary to cut away the overhanging middle turbinate bone. This having been done, the following structures will be exposed:—

1. The hiatus semilunaris.
2. The infundibulum.
3. The openings of the anterior ethmoidal cells.
4. The opening of the antrum of Highmore.
5. The ethmoidal bulla.
6. The openings of the middle ethmoidal cells.

1. *The Hiatus Semilunaris.*—The hiatus semilunaris is a deep curvilinear depression which extends from behind and below, upwards and forwards towards the infundibulum. It is bounded below by the uncinate process of the ethmoid.

2. *The Infundibulum.*—The infundibulum is a funnel-shaped passage which leads from the anterior extremity of the hiatus semilunaris directly into the frontal air sinus.

3. *The Openings of the Anterior Ethmoidal Air Cells.*—The

anterior ethmoidal air cells open into the fore part of the hiatus semilunaris immediately below the orifice of the infundibulum.

4. *The Opening of the Antrum of Highmore.*—The opening of the antrum of Highmore is usually by an orifice which is common to it and the anterior ethmoidal air cells. Not unusually, however, the antrum has a second orifice rather lower down in the hiatus semilunaris.

5. *The Ethmoidal Bulla.*—The ethmoidal bulla is an oval projection which lies above and behind the hiatus semilunaris, and immediately below the attachment of the middle turbinate bone.

6. *The Openings of the Middle Ethmoidal Air Cells.*—The openings of the middle ethmoidal air cells are either upon or just above the ethmoidal bulla.

The Inferior Meatus.—The inferior meatus extends along the whole length of the hard palate. It is the longest and widest of the three.

Opening into its anterior extremity is the termination of the nasal duct. This opening is guarded by two folds of mucous membrane in such a way as to permit the free passage of the lachrymal fluid into the nasal fossa, but to prevent the passage of air in the reverse direction.

The Anterior Extremity of the Nasal Fossa.—The anterior extremity of each nasal fossa may be described as presenting for examination:—

The anterior nares.

The vestibulum nasi.

The Anterior Nares.—The anterior nares are the anterior openings of the nasal fossæ upon the face.

The Vestibulum Nasi.—The vestibulum nasi is an oval depression in the outer wall of each nasal fossa, which is placed immediately above the anterior nares. It is bounded by the cartilage of the nasal aperture and by the columna nasi, and from its lining membrane, which is covered by stratified squamous epithelium, project a number of hairs termed *vibrissæ*.

The Mucous Membrane of the Nose.—The mucous membrane of the nose, the pituitary membrane, or the Schneiderian membrane, is a thick, highly vascular structure

which is firmly united to the subjacent periosteum or perichondrium.

It is continuous with the skin in the vestibulum nasi, with the pharyngeal mucous membrane, with the conjunctiva through the nasal duct, and with the various air sinuses of the surrounding bones.

The mucous membrane of the nose either very greatly reduces the size of the various orifices which open into or out of the nasal fossæ on the dried skull, or actually closes them, as in the case of those apertures such as the incisor and sphenopalatine foramina which transmit vessels and nerves only.

The character of the epithelium in connection with the nasal mucous membrane varies in different situations, and so permits of a natural division of the mucous membrane into three parts:—

The vestibulum nasi.	Stratified squamous epithelium.
The olfactory region.	Non-ciliated and columnar epithelium.
The respiratory region.	Ciliated and columnar epithelium.

The Vestibulum Nasi.—This has already been described in connection with the anterior extremity of the nasal fossæ.

The Olfactory Region.—The olfactory region is the narrowed upper part of the nasal fossa which is bounded by the ethmoid bone; it extends downwards, therefore, to the lower border of the middle turbinate bone, and also comprises the upper third of the septum nasi.

The olfactory nerves are distributed within the limits of the olfactory region, which is consequently the seat of the special sense of smell. The mucous membrane in this region is thinner, softer, and less vascular than elsewhere, and in the recent condition is of a yellowish colour.

The Respiratory Region.—The respiratory region lies below the level of the middle turbinate bone. Its mucous membrane is thick, vascular, and of a reddish hue. It contains numerous mucous glands.

The Nerves of the Nasal Fossæ.—The nerves of the

nasal fossæ may be classified according to their function and position thus:—

	Inner or Septal Wall.	Outer Wall.
Special sensation .	The olfactory nerves.	The olfactory nerves.
Common sensation .	The naso-palatine nerve. Septal branch of the nasal nerve. Superior nasal branches from Meckel's ganglion.	Nasal branch of the anterior superior dental nerve. External branch of the nasal nerve. Superior nasal branches from Meckel's ganglion. Two inferior nasal branches from the large or anterior palatine nerve.

The Olfactory Nerves.—The olfactory nerves, about twenty in number on each side, arise within the cranium from the inferior surface of the olfactory bulb as it rests upon the cribriform plate of the ethmoid.

They pass into the nasal fossæ through the various apertures in the cribriform plate of the ethmoid, and divide into two groups, inner and outer.

The *inner* group pass downwards on the vertical plate of the ethmoid, to be distributed to the olfactory mucous membrane over the upper third of the septum.

The *outer* group are distributed to the olfactory mucous membrane over the outer wall of the nasal fossæ as low down as the lower border of the middle turbinate bone.

The Nasal Nerves of Common Sensation.—These have been described elsewhere.

The Arteries of the Nasal Fossæ.—The various small arteries of the nasal fossæ may be classified thus:—

<i>Inner or Septal Wall.</i>	<i>Outer Wall.</i>
1. The naso-palatine from the nasal or sphenopalatine artery.	1. The nasal or sphenopalatine artery from the third part of the internal maxillary.
2. A branch from the anterior ethmoidal artery.	2. Branches from the anterior ethmoidal artery.
3. Small branches from the posterior ethmoidal artery.	3. Branches from the posterior ethmoidal artery.
4. Septal branch of the superior coronary artery.	4. Branches from the descending palatine artery from the third part of the internal maxillary.

XIV. THE PREVERTEBRAL REGION

Definition.—The prevertebral region is the unimportant region which lies immediately in front of the cervical vertebræ. It comprises the prevertebral muscles, the origins of the cervical spinal nerves, and the vertebral vessels.

The Prevertebral Muscles.—The prevertebral muscles are three in number on each side, as follows:—

The longus colli muscle.

The rectus capitis anticus major muscle.

The rectus capitis anticus minor muscle.

The Longus Colli Muscle.—This muscle rests upon the vertebræ, extending from the third dorsal vertebra to the atlas. It consists of three parts—a vertical portion, a lower oblique portion, and an upper oblique portion.

The *vertical* portion is the largest of the three divisions, and lies to the inner side of the two oblique portions. It *arises* from the bodies of the last two cervical and first two dorsal vertebræ, and, passing upwards, is *inserted* into the bodies of the second, third, and fourth cervical vertebræ.

The *lower oblique* portion *arises* from the lateral aspects of the bodies of the first two dorsal vertebræ, and, passing upwards and outwards, is *inserted* into the anterior tubercles of the transverse processes of the fifth and sixth cervical vertebræ. The vertebral artery passes upwards and backwards between this part of the muscle and the scalenus anticus.

The *upper oblique* portion *arises* from the anterior tubercles of the transverse processes of the third, fourth, and fifth cervical vertebræ, and, passing upwards and inwards, is *inserted* into the tubercle on the anterior arch of the atlas.

Nerve Supply.—The cervical nerves.

Action.—Principally a flexor of the head on the spine.

The Rectus Capitis Anticus Major Muscle.—*Origin.*—From the anterior tubercles of the transverse processes of the third, fourth, fifth, and sixth cervical vertebræ.

Insertion.—The muscle passes upwards and inwards, to be inserted into the basilar process of the occipital bone, just in front of the foramen magnum.

Nerve Supply.—The nerve loop between the anterior primary divisions of the first and second cervical nerves.

Action.—A flexor of the head on the spine.

The Rectus Capitis Anticus Minor Muscle.—*Origin.*—From the front of the root of the transverse process of the atlas.

Insertion.—The muscle passes upwards and inwards, to be inserted into the basilar process of the occipital bone between the foramen magnum and the insertion of the rectus capitis anticus major, and about half an inch external to the middle line of the body.

Nerve Supply.—The nerve loop between the anterior primary divisions of the first and second cervical nerves.

Action.—A flexor of the head on the spine at the occipito-atlantal articulation.

The Cervical Nerves.—The anterior primary divisions of the *lower six* of the eight cervical nerves pass outwards between the cervical intertransversales muscles.

The posterior primary divisions of the lower six cervical nerves pass backwards behind the cervical intertransversales muscles.

The *first and second* cervical nerves differ slightly from the lower six, as they leave the spinal canal above the neural arches of the atlas and axis respectively.

The anterior and posterior primary divisions of the *first* cervical or suboccipital nerve have already been described. (See pages 147 and 34.)

The anterior primary division of the *second* cervical nerve pierces the anterior atlanto-axial ligament, and then passes forwards between the first cervical intertransversales muscles and on the outer side of the vertebral artery to join the cervical plexus.

The Vertebral Artery.—The origin and termination of this artery have been described elsewhere. The relations of the artery to the cervical nerves are somewhat complicated. They may be summarised as follows:—

1. The anterior primary divisions of the lower six cervical nerves pass outwards *behind* that portion of the artery which ascends in the vertebralarterial foramina.

2. The anterior primary division of the second cervical nerve passes forwards on the *outer* side of the artery.

3. The anterior primary division of the first cervical nerve passes forwards on the *inner* side of the artery.

4. The posterior primary division of the first cervical nerve passes backwards into the suboccipital triangle *below* the artery, between it and the posterior arch of the atlas.

5. The vertebral branches from the inferior cervical ganglion of the sympathetic accompany the artery in the form of a plexus.

Branches.—The branches of the vertebral artery may be classified thus:—

In the vertebrarterial foramina.

Lateral spinal branches.

Muscular branches.

In the suboccipital triangle.

Muscular branches.

Anastomotic branches.

In the cranium.

The posterior spinal artery.

The posterior inferior cerebellar artery.

The anterior spinal artery.

Bulbar branches.

The basilar artery formed by the junction of the two vertebrals.

The Vertebral Vein.—The vertebral vein differs from the artery inasmuch as it does not arise within the cranial cavity.

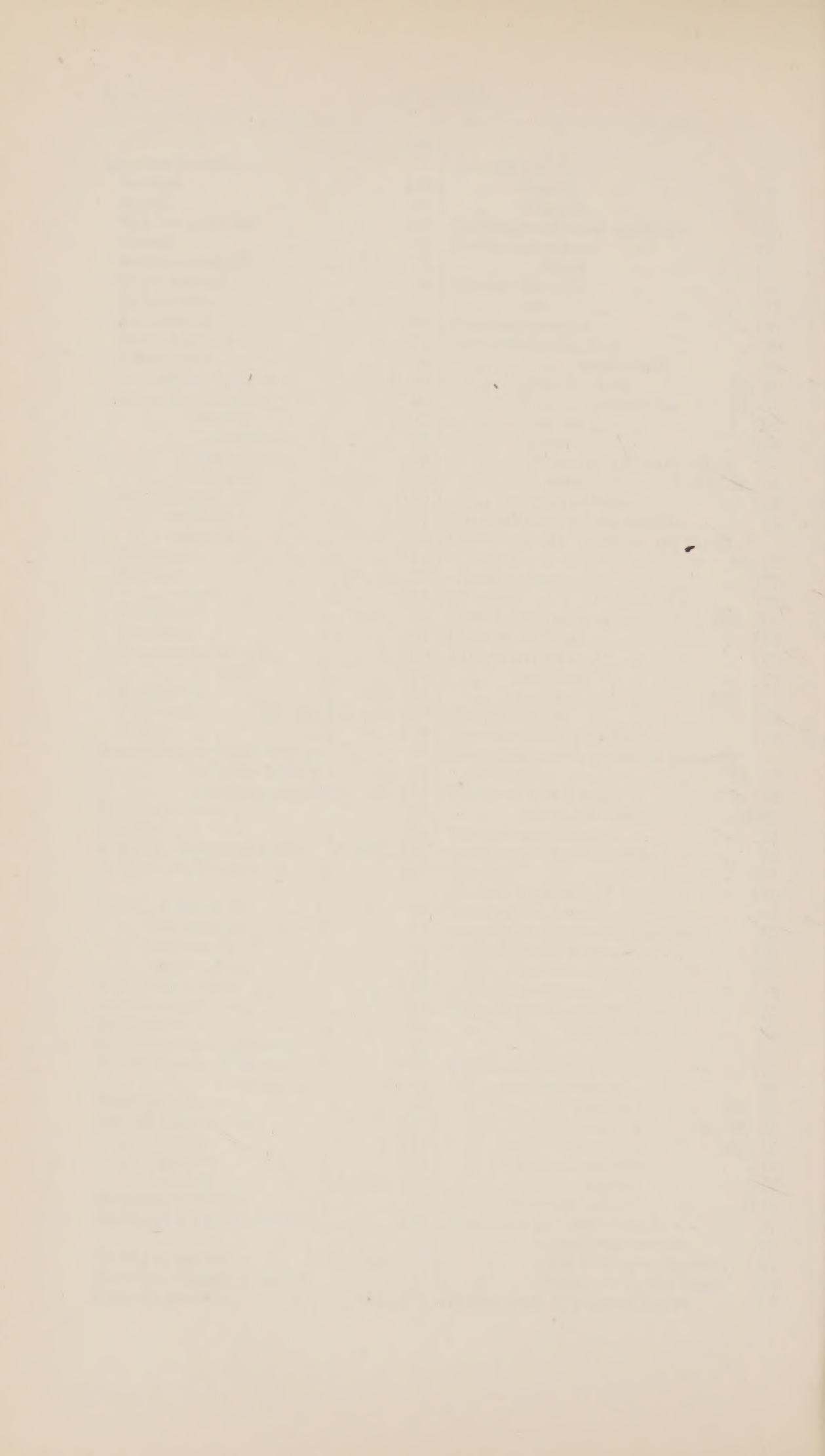
It commences in the suboccipital triangle in the union of some small venous radicles which communicate with the tributaries of the occipital and deep cervical veins and with the intra-spinal venous plexus; the vein accompanies the artery, around which it forms a plexus, through the vertebrarterial foramina, and terminates in the innominate vein of the corresponding side.

Tributaries.—The vertebral vein receives tributaries corresponding to the cervical branches of the artery, and is joined, in addition, by the anterior vertebral vein and the deep cervical vein.

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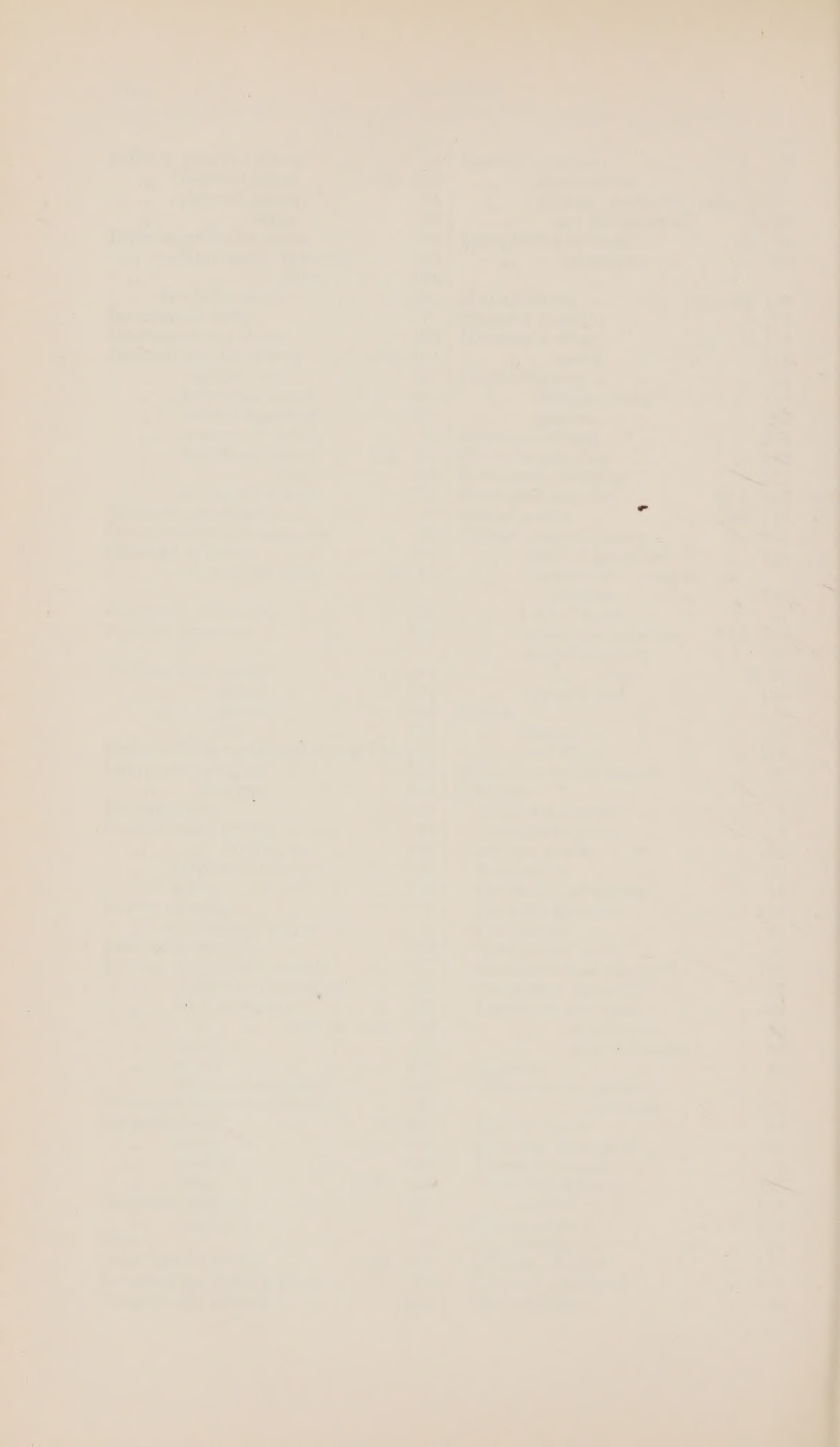
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